

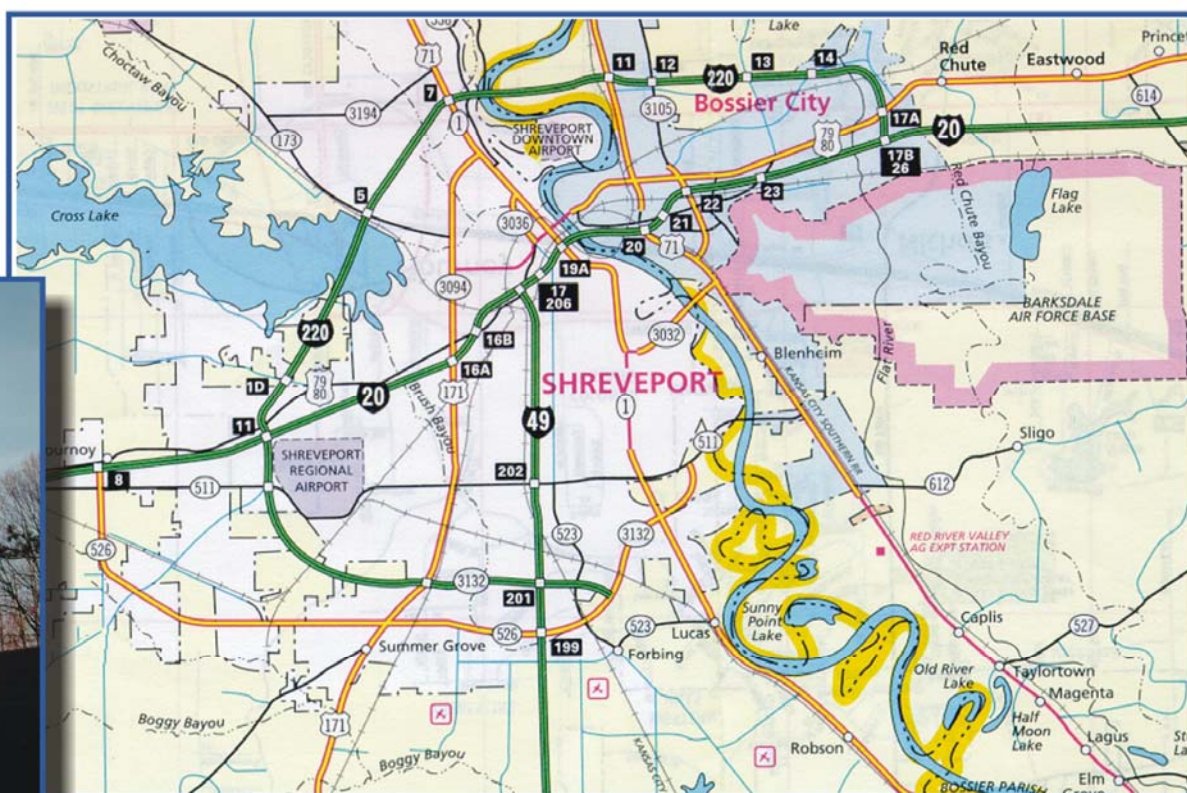


Shreveport / Bossier City Regional ITS Strategic Deployment Plan



Louisiana Transportation Information System

Prepared for the :
**Louisiana Department of
Transportation and Development**



Prepared by:

URS

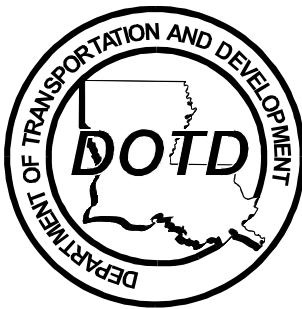
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SHREVEPORT / BOSSIER CITY REGIONAL ITS STRATEGIC DEPLOYMENT PLAN

**FAP No. SPR-9922(001)
State Project No. 700-99-0253**

Prepared for:

**Louisiana Department of
Transportation and Development**



Louisiana Transportation Information System

By:

URS



May 2002

Notice to Reader:

Background information, design bases, and other data provided to URS have been used in preparing this report. URS has relied on this information as furnished and is not responsible for, and has not necessarily confirmed the accuracy of this information. This report is based on data, site conditions, and other information, which is generally applicable as of April 2002. Therefore, the conclusions and recommendations herein are therefore applicable only to that timeframe.

This "ITS Strategic Deployment Plan" is not to be used as the final guideline for ITS System Implementation. Cost and manpower estimates submitted herein are based on time-honored practices within the industry. URS does not control the cost of labor, materials, and equipment. The estimates represent URS's best judgement as design and planning professionals, using the information available at the time of preparation. URS cannot guarantee that proposals, bid, or construction costs will not vary from these estimates.

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EXECUTIVE SUMMARY

ES.1 Proposed Deployment

The proposed ITS deployment for the Shreveport/Bossier City region was determined through a series of meetings, work sessions, interviews, and close coordination with the region's stakeholders including:

- DOTD District 04 and Headquarters
- City of Bossier City
- City of Shreveport
- Northwest Louisiana Council of Governments
- Louisiana State Police
- SPORTRAN
- Transportation Incident Management Committee (TIMs)

The proposed deployment is generally consistent with the area's current and proposed future Congestion Management System (CMS) corridors and is intended to address transportation system deficiencies within the region. The deployment is grouped into timeframes (Immediate, Near, Mid, and Long-Term) and phases to reflect the stakeholders' implementation priorities with consideration of potential funding constraints (i.e. the deployment is fiscally constrained). The fiscally-constrained deployment for the Immediate/Near/Mid-Term Program is illustrated in **Figure 3.11** and summarized in **Table 3.13a**. The Immediate/Near/Mid-Term fiscally-constrained deployment program includes the upgrade and integration of all traffic signals within the Cities of Shreveport and Bossier City and includes deployment along the critical segments of I-20, I-220 and I-49 within the region. A concise summary of the proposed deployment, grouped by timeframe and phase, is presented in **Tables 3.13a and 3.13b**. The Transit ITS Deployment Program, based on the ITS Architecture and meetings with SPORTRAN, is summarized separately in **Table 3.16**.

Objectives of the proposed ITS deployment are to:

1. Improve traffic flow on the arterial street system within the region and address the outdated/antiquated traffic signal control system in the City of Shreveport, while integrating the Bossier City traffic signal control system.
2. Reduce existing and projected interstate congestion, with specific emphasis on reducing non-recurring congestion impact on the interstate.
3. Improving Incident Management through more effectively detecting, verifying, responding and clearing incidents.

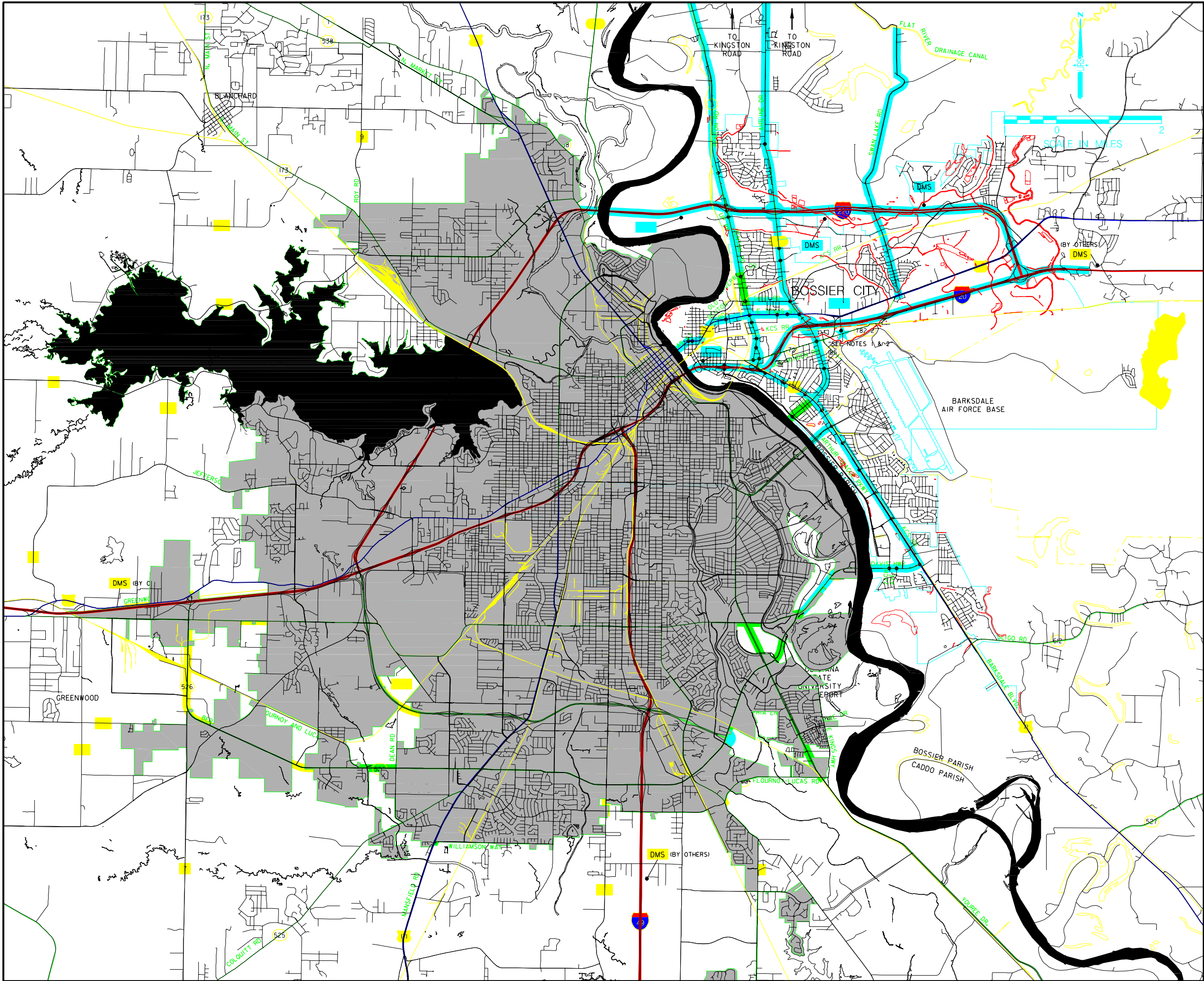
4. Improving safety on the transportation system within the region.
5. Provide real time information to travelers regarding congestion, incidents, work zones and roadway conditions.
6. Improve transit bus operations by providing real time bus status information to transit users, and improving security on buses.

The ITS strategies to be deployed include:

- Advanced Surface Street Control with regional traffic control (including upgrade of all traffic signal systems within the City of Shreveport and integration of the Bossier City system).
- Advanced Freeway and Incident Management Systems including network surveillance.
- Advanced Traveler Information Dissemination Systems.
- Roadway Weather Information Systems.
- Emergency Management Systems.
- Advanced Public Transportation Systems.

To implement these strategies the ITS field deployment for the Shreveport/Bossier City region will consist of 579 radar vehicle detectors (RVDs), 220 closed-circuit television (CCTV) cameras, 15 dynamic message signs (DMSs), signal system improvements at 395 intersections, 10 weather stations, and 4 highway advisory radio (HAR) stations.

Communications to and from these field devices is proposed via a fiber optic trunk line and hybrid fiber/wireless distribution system. Management of the Immediate-term and a portion of the Near-term deployment is envisioned from Interim TMCs at the existing DOTD District 04 office and the existing City of Shreveport Traffic Engineering office. A new Regional Transportation Management Center (RTMC) will ultimately be constructed to consolidate resources and facilitate effective regional system operations.



- LEGEND
- INTERSTATE ROUTE
 - UNITED STATES ROUTE
 - STATE ROUTE
 - PARISH ROUTE
 - IMMEDIATE-TERM PRIORITY
 - NEAR-TERM PRIORITY
 - MID-TERM PRIORITY (SEE NOTE 3)
 - SIGNALIZED INTERSECTION
 - DMS DYNAMIC MESSAGE SIGN

- NOTES:
- INTERIM TMC COMPONENTS TO BE LOCATED AT EXISTING DOTD DISTRICT 04 OFFICE (3339 INDUSTRIAL DR., BOSSIER CITY) AND EXISTING CITY OF SHREVEPORT TRAFFIC ENGINEERING OFFICE (2123 LAKESHORE DR., SHREVEPORT).
 - REGIONAL TMC TO BE LOCATED AT SITE OF EXISTING DOTD DISTRICT 04 OFFICE.
 - MID-TERM PRIORITY INCLUDES ALL REMAINING TRAFFIC SIGNALS IN SHREVEPORT (APPROX. 79).
 - A TOTAL OF THREE DYNAMIC MESSAGE SIGNS ARE PLANNED BY OTHERS (REDUCED VISIBILITY ENHANCEMENT PHASE 2 S.P. No. 737-99-0467) AS NOTED.



Shreveport/Bossier City Regional ITS
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Figure 3.11
Fiscally-Constrained ITS Deployment
(Immediate/Near/Mid-Term Program)

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**Table 3.13a Summary of Fiscally-Constrained ITS Deployment
(Immediate/Near/Mid-Term Program)**

Timeframe	Phase	Description	Construction Cost ⁽¹⁾	Design Cost ⁽²⁾
All	All	primary (trunkline) communications	\$8,244,000	\$824,400
		secondary (distribution) communications		
		SUBTOTAL	\$8,244,000	\$824,400
Immediate	1	11 CCTV cameras signal system improvements at 27 intersections	\$951,600	\$95,160
	2	signal system improvements at 26 intersections	\$3,120,000	\$312,000
	3	signal system improvements at 22 intersections	\$2,640,000	\$264,000
		SUBTOTAL	\$6,711,600	\$671,160
Near	1	DOTD Interim TMC Shreveport Interim TMC DOTD Interim TMC Software & Integration Shreveport Interim TMC Software & Integration 76 radar vehicle detectors 25 CCTV cameras 5 dynamic message signs 4 highway advisory radio stations	\$4,686,000	\$468,600
	2A	RTMC	\$3,600,000	\$360,000
	2B	RTMC Software & Integration	\$2,400,000	\$240,000
	3	88 radar vehicle detectors 32 CCTV cameras 5 dynamic message signs	\$3,895,200	\$389,520
	4	signal system improvements at 21 intersections	\$2,520,000	\$252,000
	5	10 CCTV cameras signal system improvements at 76 intersections	\$9,396,000	\$939,600
	6	signal system improvements at 17 intersections	\$2,040,000	\$204,000
	7	8 CCTV cameras 3 dynamic message signs	\$760,800	\$76,080
		SUBTOTAL	\$29,298,000	\$2,929,800
Mid	1	12 radar vehicle detectors 15 CCTV cameras 2 dynamic message signs	\$1,062,000	\$106,200
	2	signal system improvements at 38 intersections	\$912,000	\$91,200
	3	signal system improvements at 18 intersections	\$432,000	\$43,200
	4	signal system improvements at 30 intersections	\$720,000	\$72,000
	5	signal system improvements at 27 intersections	\$648,000	\$64,800
	6	signal system improvements at 14 intersections	\$336,000	\$33,600
	7	signal system improvements at 79 intersections	\$1,896,000	\$189,600
		SUBTOTAL	\$6,006,000	\$600,600
TOTAL			\$50,259,600	\$5,025,960

(1) Purchase and installation cost. Includes 20% contingency. Year 2002 dollars.

(2) 10% of "Construction" cost. Year 2002 dollars.

Note: Transit deployment not included (see *Table 3.16*).

**Table 3.13b Summary of Fiscally-Constrained ITS Deployment
(Long-Term Program)**

Timeframe	Phase	Description	Construction Cost ⁽¹⁾	Design Cost ⁽²⁾
Long	-	403 radar vehicle detectors 119 CCTV cameras additional upgrades to Shreveport signal system at 206 intersections 10 weather stations (includes one CCTV camera per station) Regional Maintenance Facility	\$35,024,400	\$3,502,440
TOTAL			\$35,024,400	\$3,502,440

(1) Purchase and installation cost. Includes 20% contingency. Year 2002 dollars.

(2) 10% of "Construction" cost. Year 2002 dollars.

Note: Transit deployment not included (see **Table 3.16**).

Table 3.16 Summary of Proposed Transit ITS Deployment (Unconstrained)

Phase & Investment		Estimated Implementation Cost	Comments
Near-Term			
N-1:	Preliminary Design & Communications System Study	\$50,000	Study to detail overall ITS transit needs and analyze communications issues.
N-2:	Radio System Upgrade (partial)	\$400,000	Preliminary estimate for dispatch center equipment only; communications system study required to further identify cost.
N-3:	CAD/AVL System with APCs and Enunciators	\$1,750,000	AVL for all vehicles, including additional radio system upgrade, supervisory and maintenance. APCs for approximately 4 fixed-route vehicles; enunciators for all fixed-route vehicles.
Near-Term Subtotal		\$2,200,000	
Mid-Term			
M-1:	Demand-Responsive Passenger Information/Fare System	\$250,000	Cost includes specification development.
M-2:	Initial Real-Time Bus Status Information System and Transfer Coordination	\$200,000	Can be bundled with N-3, which will provide the design and integration. This cost is for hardware (signs) and installation.
M-3:	Automated Trip Planning System	\$300,000	Includes cost for software.
M-4:	Expanded Real-Time Bus Status Information System	\$200,000	Additional signs/monitors.
M-5:	Enhanced Demand-Responsive Service Coordination	\$250,000	Utilize systems implemented in N-3. This cost supports any required communications or software additions.
Mid-Term Subtotal		\$1,200,000	
Long-Term			
L-1:	On-Board and Station Security Recording	\$300,000	Selected routes/vehicles and key stops/centers.
L-2:	Enhanced Vehicle Monitoring	\$350,000	Cost dependent on specific approach.
L-3:	Real-Time On-Board Security Monitoring	\$500,000	None.
Long-Term Subtotal		\$1,150,000	None.
Program Total		\$4,550,000	

(1) Contingency not included. Year 2002 dollars.

ES.2 Regional TMC

The Regional Transportation Management Center (RTMC) (see **Figure 8.1**) will be the center of operations and communications for the Shreveport / Bossier City ITS deployment network. The RTMC will house the Regional ITS Command and Control Center, DOTD District 04 Traffic Engineering Services, City of Shreveport Traffic Engineering staff, as well as City of Bossier City traffic operators.

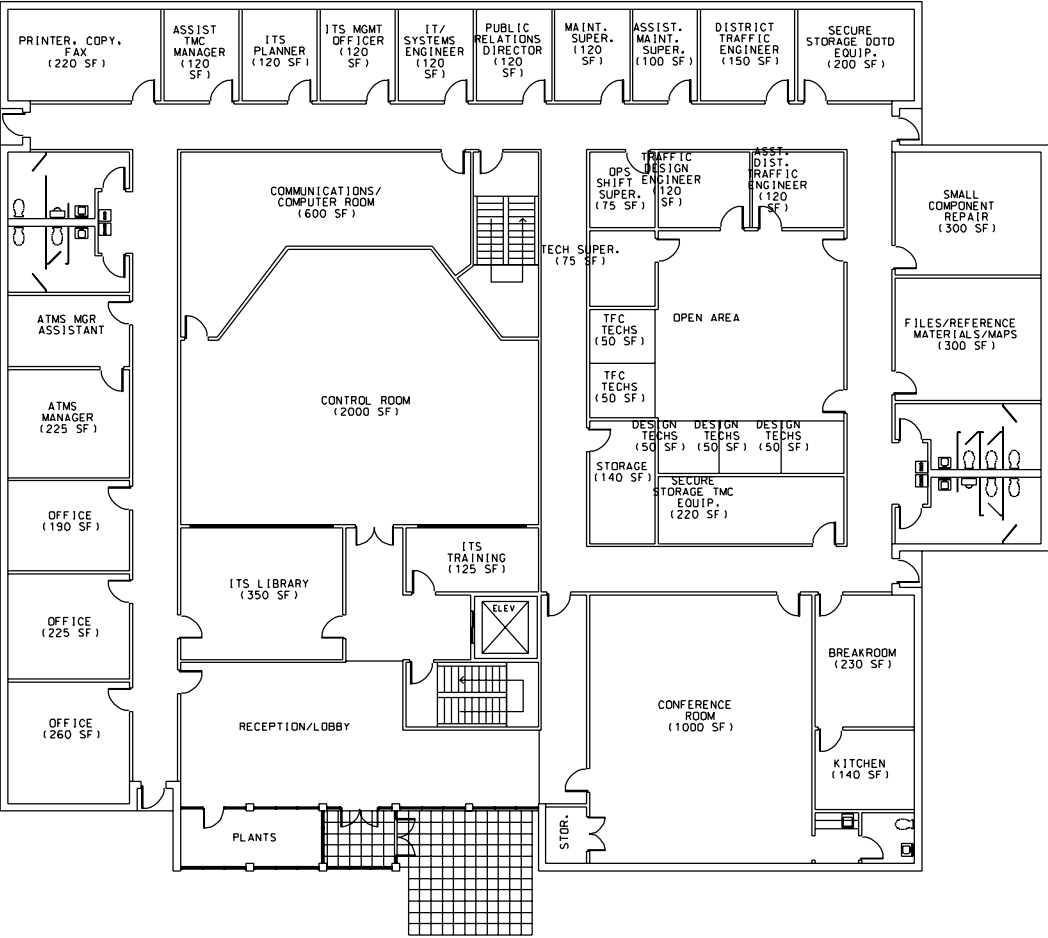
This RTMC and associated systems will be part of the Statewide ITS and will be linked to the other centers across Louisiana with remote operations capabilities. This facility will provide improvements to the management of both freeway and arterial traffic while creating an environment for complete access to all resources / information by all the participating agencies.

ES.3 Action Plan

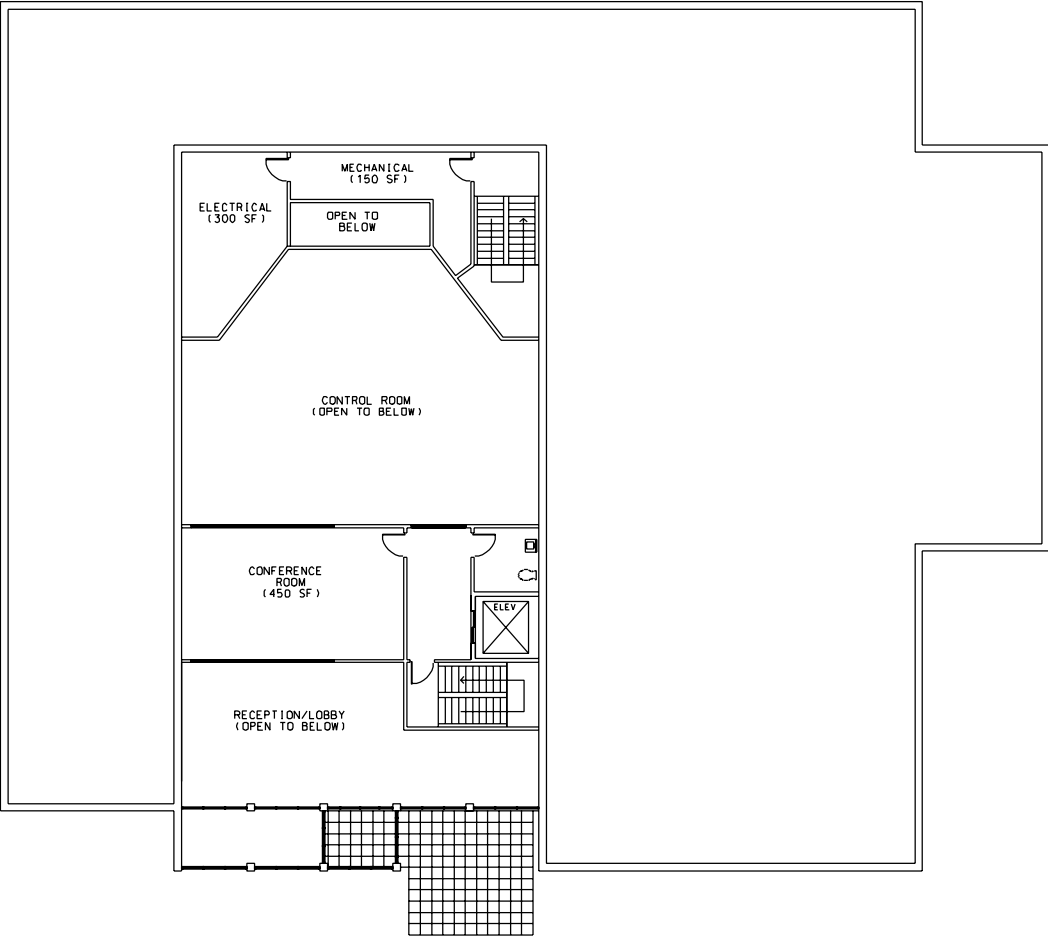
The Action Plan focuses on the Immediate-term and Near-term fiscally-constrained proposed ITS Deployment. It defines special actions that need to be taken to advance the DOTD ITS Deployment Program within the Shreveport / Bossier City region.

Action items can be divided into three categories:

1. Project Specific / Integration: Focuses on specific actions necessary to facilitate the timely deployment of high-priority deployment projects (see **Table 9.1**).
2. Interagency / Operations and Maintenance Agreements: Focuses on specific actions necessary to resolve institutional issues, implement the Regional ITS organizational structure, and develop operations and maintenance agreements. (See **Table 9.2**).
3. Funding: Focuses on actions necessary to pursue funding for future capital needs. (See **Table 9.3**).



RTMC - FIRST FLOOR PLAN
NOT TO SCALE



RTMC - SECOND FLOOR PLAN
NOT TO SCALE



Shreveport/Bossier City Regional ITS
Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
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Figure 8.1
Preliminary Regional TMC Floor Plan

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URS Project No. 04-00046316.02 | DATE: MAY 2002

Table 9.1 Necessary Actions: Project Specific / Integration

Proposed Deployment	Necessary Action
Immediate-Term Phase 1, 2 and 3 Deployment <ul style="list-style-type: none"> Signal System Improvements Communications interconnect DOTD Interim TMC Shreveport Interim TMC Communications System Software & Integration	<ol style="list-style-type: none"> URS prepare Scope and Fee estimate for Design Services (preparation of PS&E) not performed by DOTD in house. Execute Task Order for Design Perform pre-design scoping task Prepare Preliminary and Final Design PS&E
Regional TMC	<ol style="list-style-type: none"> Initiate planning task to refine schematic layout of TMC, site location, and facility planning Submit RTMC Plan to FHWA for verification of Federal participation Finalize funding program for RTMC Execute Memorandum of Understanding (MOU) between participating parties for RTMC Operations and Maintenance Initiate Task Order to perform Architectural services for RTMC Prepare Preliminary and Final PS&E

Table 9.2 Necessary Actions: Interagency / Operations & Maintenance Agreements

Project	Action
Regional TMC	<ol style="list-style-type: none"> Initiate detailed discussion regarding the level of participation and integration of other stakeholders into the Regional transportation management system, i.e. State Police, EMS 911, Shreveport Police, Bossier City Police, Caddo Parish Sheriff's Office, Bossier Sheriff's Office Prepare Draft MOU between DOTD, NLCOG, City of Shreveport, Bossier City and FHWA regarding the operations, maintenance and funding of the RTMC and transportation management system. Other stakeholders may be involved based on Item No. 1 Coordinate MOU among parties and execute Establish Regional ITS Policy Committee and TMC Operations Committee

Table 9.3 Necessary Actions: Funding

Project	Action
Regional Transportation Management System	<ol style="list-style-type: none"> Prepare and submit request for Federal funding of RTMC, Near-Term Phase 1 Deployment, and signal system improvement for new transportation bill authorization Prepare and submit Integration Grant Applications for priority projects Provide prioritized list and project descriptions to NLCOG to pursue funding with local/regional delegation Prepare Grant application for FTA funding for SPORTRAN Transit ITS System

1.0 IDENTIFICATION OF TRANSPORTATION DEFICIENCIES

The identification of transportation system deficiencies, such as congestion and high-incident locations, on the roadway network is an important element of the Intelligent Transportation Systems (ITS) planning process. Through stakeholder interviews and a review of the local CMS Plan (*Congestion Management System Plan for the Shreveport/Bossier City TMA*, Northwest Louisiana Council of Governments (NLCOG), adopted April 2, 1998) and the Transportation Plan Update (*Shreveport/Bossier City Transportation Plan Update* (Parsons Brinckerhoff Quade & Douglas (PBQD), September 2001 preliminary draft), identified deficiencies can be prioritized and potential ITS strategies evaluated to address such deficiencies.

This section is intended to support the preparation of the overall Strategic Plan for the Shreveport/Bossier City region by documenting the locations of major deficiencies in the Shreveport/Bossier transportation system, as identified by the local stakeholders, including: the Louisiana Department of Transportation and Development (DOTD), NLCOG as the local Metropolitan Planning Organization (MPO), the Cities of Shreveport and Bossier City, the Incident Management Committee and Sportrans.

1.1 CMS Corridors

The CMS Plan identifies transportation facilities currently experiencing substantial levels of congestion. These CMS corridors are selected by a Technical Coordinating Committee (TCC) in consideration of volume/capacity (v/c) ratios (≥ 0.70), combined with average daily traffic (ADT) counts and growth trend information.

As of April 1998, a total of ten of what were considered the most congested corridors were identified and included in the CMS analysis. The ten CMS corridors represent about 85 miles (one-way length) of the roadway network within the Shreveport/Bossier City region. All are classified as principal arterials with the exception of I-20 (east and west), which is considered an interstate (limited access) facility. The CMS also targeted six additional corridors, totaling about 57 miles, to be incorporated into the CMS to account for and monitor anticipated traffic growth.

The current and anticipated future CMS corridors (as of April 1998) are listed in **Tables 1.1** and **1.2** and illustrated in **Figure 1.1**. The congested locations identified in the 1998 CMS Plan were then updated and modified through stakeholder interviews and the Transportation Plan Update review process, as discussed later in this document.

Table 1.1 Current CMS Corridors

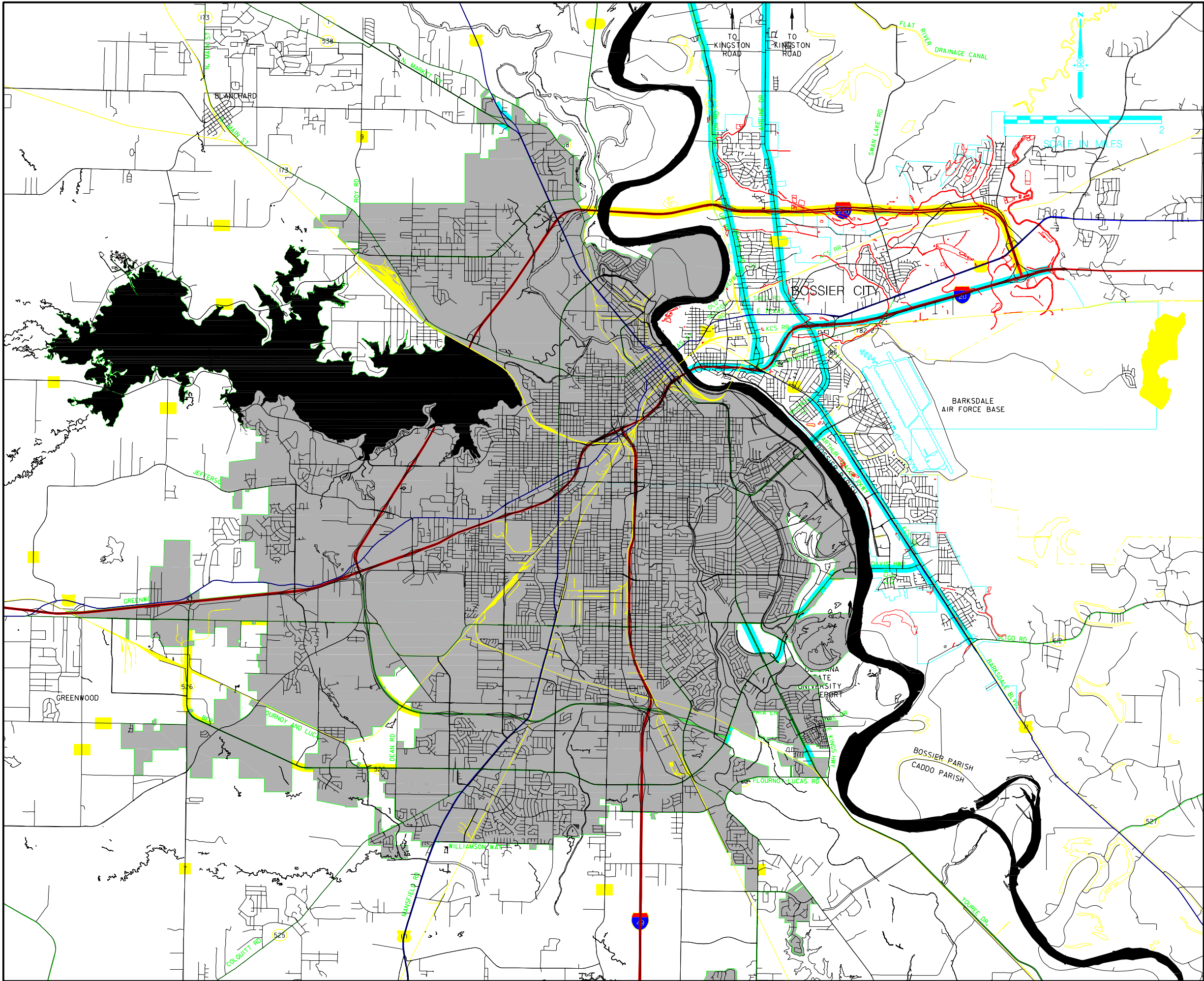
Corridor	Location	Length (Miles)
1. I-20 West	Pines Road Exit to Lake Street signal	8.96
2. I-20 East	I-220 Exit to Lake Street signal	7.94
3. US 171	US 71 / LA 1 to Williamson Way	11.58
4. Industrial Loop (LA 526, LA 3132 and LA 511)	US 71 to Walker Road	11.24
5. LA 1	I-20 to LA 523	9.65
6. LA 3032 and Kings Highway	US 71 to US 171	5.76
7. US 71 / LA 1	US 71 / LA 1 Split to I-20	6.84
8. LA 3	Kingston Road to I-20	8.03
9. LA 3105	Kingston Road to US 71	8.90
10. US 71	LA 3105 to Curtis-Sligo Road	5.56
TOTAL		84.46

Source: *CMS Plan for the Shreveport/Bossier TMA* (NLCOG, adopted 4/2/98).

Table 1.2 Future CMS Corridors

Corridor	Location	Length (Miles)
1. I-49	I-20 to LA 526	7.02
2. I-220 / LA 3132	I-20 (East) to LA 526	26.97
3. LA 526	Walker Road to US 79/80	7.43
4. LA 173	I-220 to LA 3194	2.40
5. Jewella Road	I-20 to US 171	4.30
6. LA 511	LA 526 to I-49	8.98
TOTAL		57.10

Source: *CMS Plan for the Shreveport/Bossier TMA* (NLCOG, adopted 4/2/98).



- LEGEND
- INTERSTATE ROUTE
 - UNITED STATES ROUTE
 - STATE ROUTE
 - PARISH ROUTE
 - CURRENT CMS CORRIDOR
 - FUTURE CMS CORRIDOR

SOURCE:
CONGESTION MANAGEMENT SYSTEM (CMS) PLAN
FOR THE SHREVEPORT/BOSSIER CITY TMA
(NLCOG, ADOPTED 4/29/98)

Shreveport/Bossier City Regional ITS
Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253

Figure 1.1
Current & Future CMS Corridors

URS
PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.

URS Project No. 04-00046316.02 | DATE: MAY 2002

1.2 STAKEHOLDER ISSUES

The previously identified CMS corridors set the stage for a fresh look by local stakeholders at what they currently consider to be the important transportation issues and roadway network deficiencies within the Shreveport/Bossier City region.

In September and November of 2001, URS Corporation (URS) conducted interviews with local stakeholders, including representatives of DOTD, NLCOG, the Cities of Shreveport and Bossier City, Incident Management Committee representatives and Sportrans. All agreed that safety and efficiency within the Transportation System are top priorities. Specific issues of concern are summarized in *Table 1.3*.

Table 1.3 Primary Transportation Issues

• Interstate Congestion / Capacity Deficiencies
• Arterial Capacity Deficiencies
• Outdated / Antiquated Surface Street Control System
• Delay And Safety At Highway / Rail Grade Crossings
• Bridge Capacity And System Linkage
• Lack Of Real-Time Traveler Information
• Effects Of Incidents / Non-Recurring Congestion / Incident Management
• Ability To Quickly Detect, Locate And Verify Incidents, Incident Management Training
• Inter-Agency Coordination And Operation Of Surface Street Control System
• Construction Zone Safety And Congestion
• Communications Among Emergency Management Agencies
• Security On Transit Buses
• Lack Of Real-Time Information / Status To Transit Users
• Centralized Control And Management Of Transportation System
• Lack Of Funding For Capacity Improvements And Maintenance
• Fleet Management / AVL
• Bicyclist And Pedestrians

Source: Stakeholder interviews.

1.2.1 General Development and Traffic Trends

High growth corridors in the region, relevant to residential and commercial development resulting in rapid growth in vehicle miles traveled (VMT), include: 1) the area north of downtown Bossier City along the LA 3105 (Airline Drive) corridor, north of I-220 in Bossier Parish, and 2) the area southeast of downtown Shreveport, along the I-49 and LA 1 corridors, south of LA 526 (Industrial Loop) in Caddo Parish. Significant commercial growth is also occurring along the heavily utilized LA 526 (Industrial Loop) corridor. High growth in VMT is occurring on I-20 through the metropolitan area as interstate travel and commercial vehicle operation increases.

With this growth comes increased traffic demand and incidents at critical junctions, including: 1) the five local area bridge crossings of the Red River, particularly the I-20 and Jimmie Davis (LA 511) Bridges, 2) numerous at-grade railroad crossings, and 3) ramp junctions along the interstate system, particularly I-20 in and approaching downtown Shreveport and Bossier City. These problems are worsened by the lack of regionally coordinated traffic control systems, including the antiquated centrally-controlled Shreveport signal system. Incidents along major routes with heavy travel demand, combined with needed incident management improvements, are contributing to major traffic delays.

1.2.2 Major Activity Centers

Development sites or areas of activity can, by virtue of their size or peak-period traffic generating characteristics, contribute to roadway network deficiencies and can sometimes warrant focused ITS device deployment in their vicinity. The major traffic generators identified through the stakeholder interviews are listed in *Table 1.4*.

Table 1.4 Major Activity Centers

Site	Parish	Location
• KCS railroad yard	Caddo	Along south side of LA 173, west of I-220
• Airline Drive shopping area	Bossier	Southeast of LA 3105 / I-220 Interchange
• Pierre Bossier Mall	Bossier	Northwest of Airline Drive (LA 3105) / I-20 Interchange
• Barksdale Air Force Base	Bossier	South of I-20 and east of US 71
• General Motors Plant	Caddo	Southwest of LA 526 / I-20 Interchange
• Shreveport Regional Airport	Caddo	Southeast of I-220 – LA 3132 / I-20 Interchange
• Refinery	Caddo	Southeast of Jewella Road / I-20 Interchange
• Medical facilities area	Caddo	South of I-20 / I-49 Interchange
• Mall St. Vincent	Caddo	Southeast of I-49 / Kings Highway Interchange
• Slack Industrial Park	Caddo	Southeast of I-49 / LA 3132 Interchange
• Port of Shreveport/Bossier City	Caddo & Bossier	Between LA 1 and the Red River
• LSU Shreveport	Caddo	Southeast of LA 1/LA 3132 intersection
• CBD Shreveport/Bossier City	Caddo & Bossier	I-20 @ Red River

Source: Stakeholder interviews.

1.2.3 Congested Locations

Traffic deficiencies in roadway networks can be categorized into two basic categories: corridor congestion and bottlenecks. Sustained corridor-level congestion typically results from through traffic demand at or near the capacity of the travel lanes often combined with accidents and slow incident response. Uncoordinated signal systems can also contribute to a lack of vehicle progression and associated corridor-level congestion. Spot congestion or bottlenecks typically result from geometric or safety deficiencies at signalized intersections and ramp junctions.

The congested locations identified in the 1998 CMS Plan were updated and modified through the Transportation Plan Update review process. Congested locations identified through the stakeholder interviews, supplemented by those contained in the Transportation Plan Update, are listed in *Table 1.5* and illustrated in *Figure 1.2*.

Table 1.5 Congested Locations

Route	Parish	Location
1. LA 3132	Caddo	LA 526 to E. Kings Highway
2. LA 1	Caddo	E. Kings Highway to Sophia Lane
3. US 71	Bossier	LA 511 to I-20
4. US 71 / LA 1	Caddo	Nelson Street to south terminus of Spring / Market Street
5. LA 3105	Bossier	US 71 to Kingston Road
6. US 171	Caddo	a) LA 3132 to Southland Park Drive
	Caddo	b) Kings Highway to I-20
7. LA 173	Caddo	I-220 to County 9
8. Kings Highway	Caddo	US 171 to LA 3032 / E. Kings Highway Intersection
9. I-20	Bossier	US 71 / LA 1 Intersection to Railroad Overpass near LA 3
10. LA 511	Caddo & Bossier	I-49 to US 71
11. LA 526	Caddo	a) Baird Road to Flournoy and Lucas Road
	Caddo	b) County 147 to LA 3132

Sources: Stakeholder interviews and *Transportation Plan Update*. (PBQD, September 2001 Preliminary Draft).

1.2.4 Safety Concerns

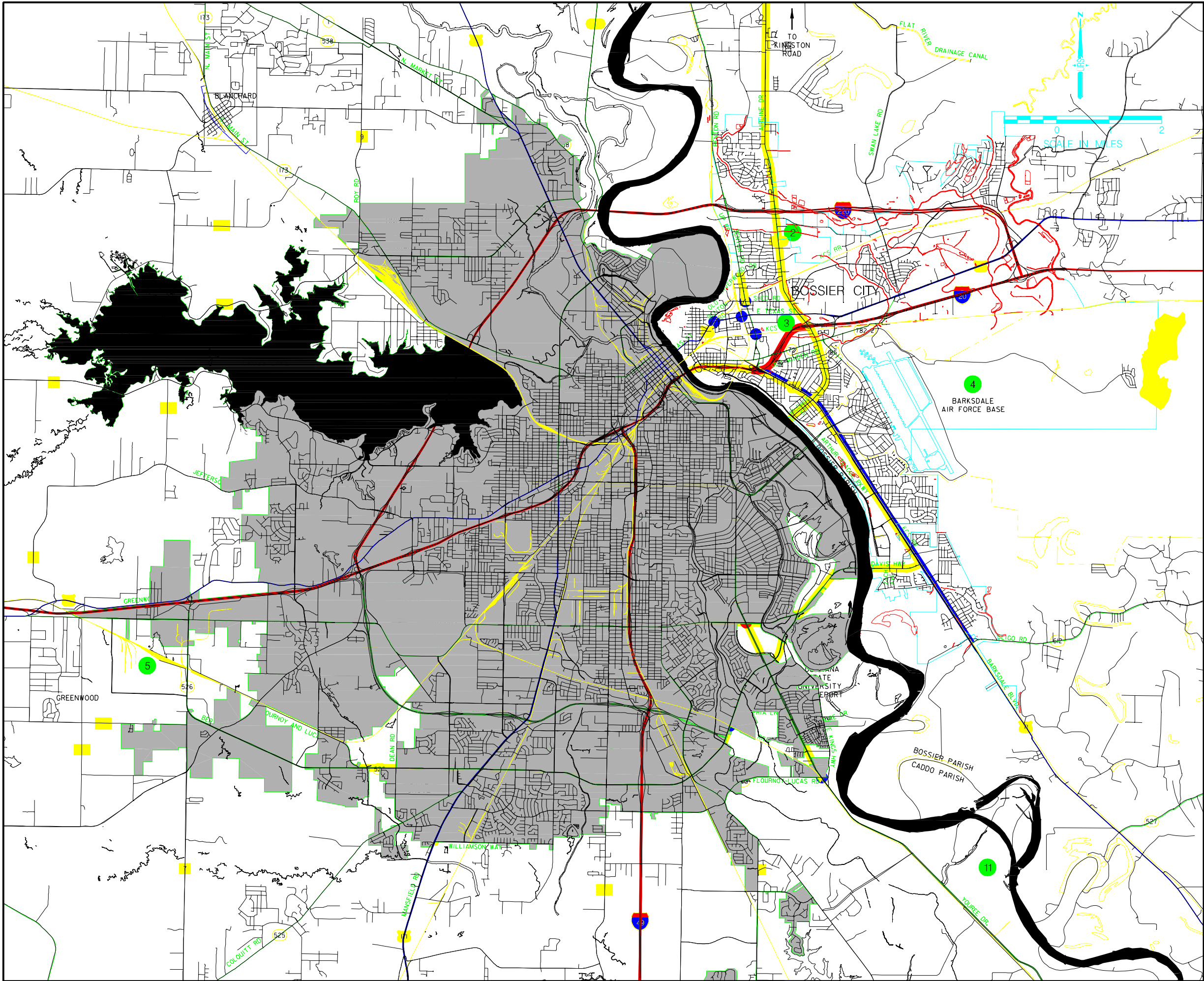
Locations with a proven history or high potential for accidents and incidents, such as at-grade intersections of highways and railroads, often justify spot deployment of ITS technology to help reduce or eliminate safety deficiencies.

The Transportation Plan Update included an examination of safety incident reports in Caddo and Bossier Parishes for a four-year (1994 through 1997) period. Locations of safety concerns as identified through the stakeholder interviews, supplemented by those contained in the Transportation Plan Update, are listed in **Table 1.6** and illustrated in **Figure 1.2**.

Table 1.6 Safety Concerns

Route	Parish	Location
1. US 71	Caddo	a) Market Street at Lake Street
	Bossier	b) KCS Crossings east of US 71, between I-20 and LA 612
2. US 71 / LA 1	Caddo	LA 3194 to Nelson Street
3. I-20	Bossier	a) LA 3105 to Railroad Overpass near LA 3
	Caddo	b) I-49 to US 71 / LA 1 Intersection
	Caddo	c) I-20 / US 171 (Hearne Avenue) Interchange
	Caddo	d) I-20 / I-220 / LA 3132 Interchange
4. LA 511	Caddo	a) LA 511 at Buncombe Road
	Caddo	b) LA 511 at US 171
	Caddo	c) LA 511 at LA 1
5. US 80	Caddo	Market Street at Texas Street
6. LA 3132	Caddo	a) Parish Route 147 to I-49
	Caddo	b) UP Crossing at LA 3132, east of LA 526
	Caddo	c) LA 3132 at LA 1
	Caddo	d) LA 3132 / US 171 Interchange
7. Blanchard	Caddo	KCS Crossings west of LA 173
8. LA 526	Caddo	UP Crossing at LA 526, east of US 171
9. LA 523	Caddo	a) UP Crossing at LA 523, west of LA 1
	Caddo	b) UP Crossing north of LA 523 / LA 3132 Interchange
10. Downtown Shreveport	Caddo	a) KCS and UP Crossing between I-20 and the Red River
	Caddo	b) UP Crossings between Spring Street and the Red River
11. Texas Street	Bossier	a) UP Crossing at Texas Street, east of Old Benton Road
	Bossier	b) KCS – UP Crossing at Texas Street, west of LA 3
12. LA 3	Bossier	a) KCS Crossing at LA 3, south of Texas Street
	Bossier	b) KCS Crossing at LA 3, north of Texas Street

Sources: Stakeholder interviews and *Transportation Plan Update*. (PBQD, September 2001 Preliminary Draft).





INTERSTATE ROUTE
UNITED STATES ROUTE
STATE ROUTE
PARISH ROUTE



ROADWAY SAFETY CONCERNS
RAIL CROSSING SAFETY CONCERNS
ROADWAY CONGESTION



MAJOR TRAFFIC GENERATOR
KCS RAILROAD YARD
AIRLINE DR. SHOPPING AREA
PIERRE BOSSIER MALL
BARKSDALE AIR FORCE BASE
GENERAL MOTORS PLANT
SHREVEPORT REGIONAL AIRPORT
REFINERY
MEDICAL FACILITIES AREA
MALL ST. VINCENT
SLACK INDUSTRIAL PARK
PORT OF SHREVEPORT/BOSSIER
LSU SHREVEPORT

NOTE:
ROADWAY SEGMENTS WITH BOTH SAFETY CONCERNS
AND CONGESTION ARE HIGHLIGHTED RED (SAFETY
CONCERNS) ONLY FOR CLARITY.

SOURCE:
STAKEHOLDER INTERVIEWS & TRANSPORTATION PLAN
UPDATE (PBQD, PRELIMINARY DRAFT, SEPT. 2001).



**Shreveport/Bossier City Regional ITS
Strategic Deployment Plan**
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253



Figure 1.2
**Locations of Roadway
Network Deficiencies**



PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.

URS Project No. 04-00046316.02

DATE: MAY 2002

2.0 REGIONAL ITS ARCHITECTURE

2.1 Introduction

This section presents the ITS system architecture for the Shreveport/Bossier City region. “System architecture” is a term traditionally used in systems engineering, and is a new concept for most people responsible for planning, designing and operating surface transportation systems. The system architecture concept has been adopted and promoted by the United States Department of Transportation (USDOT) as a tool for describing, using a standard vocabulary and concepts, the components and relationships that comprise an ITS deployment. That deployment may be either an individual ITS project or the ITS system for an entire region.

An ITS architecture provides a framework to address how system components interact and work together to achieve the system goals. An ITS architecture is different from system design, in that it describes what is to be deployed but not how those systems are to be implemented. Within the framework of an architecture, different designs can be applied. An ITS architecture could be described as a “road map” for system development.

The process for developing a regional ITS architecture for the Shreveport/Bossier City region is based on the National ITS Architecture, developed by the USDOT. Compliance with the National Architecture is mandatory. As part of the Final Rule published by the Federal Highway Administration (FHWA) on January 8, 2001, the USDOT has made compliance with the National ITS Architecture a contingency for receiving Federal funds for ITS projects. The Final Rule requires the development of a regional architecture that is consistent with the National ITS Architecture. Regions that already have ITS programs in place have up to four years from the date of this rule to develop an ITS Architecture. Further, the Final Rule requires that any projects funded through the Highway Trust Fund or the Mass Transit Account conform to the National ITS Architecture, appropriate regional architecture, and applicable standards. Developing a system architecture is a first step in complying with the USDOT requirements. **Table 2.1** summarizes the rule/policy. Complete copies of the rule and policy are contained in **Appendix A**.

In summary, the National ITS Architecture, and the Shreveport/Bossier City regional architecture, is intended to provide the following primary benefits:

- Promote a thorough, coordinated, multi-jurisdictional “system level” approach to ITS.
- By taking advantage of the USDOT’s National ITS Architecture and developing a Shreveport/Bossier City regional ITS architecture that is consistent with the National ITS Architecture, the Shreveport/Bossier City region will be able to take advantage of the growing supplier/vendor market for ITS products and services. As the standards are implemented across the nation, economies of scale will be realized in the purchase and development of ITS-related products and services.

- Foster the utilization of the “standards” that are being developed through the USDOT National ITS Architecture program. These standards identify specific formats and protocols for many of the key interfaces between ITS elements. The standards, as they are adopted by ITS implementers and ITS vendors, will allow different brands of ITS equipment to be interconnected, which will encourage coordination of ITS strategies and, in the long-term, encourage competition and reduce ITS equipment costs.

The rule and policy, which are essentially the same, require that any ITS project funded in whole or in part by Federal Highway Trust Fund money (which includes nearly all of the typical sources of Federal transportation funding, including the Mass Transit Account), be consistent with a regional ITS architecture, and utilize relevant USDOT-adopted ITS standards (none have yet been adopted). Compliance with the rule/policy is required by April 8, 2005 for regions, like the Shreveport/Bossier City region, that have or are deploying ITS projects. Certain ITS projects are exempted from the rule/policy. Until a regional architecture is in place, all major ITS projects must have a project-level architecture. It is not intended that, once in place, a regional architecture will answer all questions or necessarily dictate all specific ITS approaches. In fact, the rule/policy clearly states that modification of the regional architecture to accommodate a specific ITS project is permissible, and to varying extents, to be anticipated. The architecture represents a flexible framework that will become more specific and defined as individual project approaches are identified.

So, for a number of reasons, it is important to have a regional ITS architecture developed for the Shreveport/Bossier City region. The architecture will promote coordinated, efficient and effective ITS planning, design, implementation and operation; should, in the long-term, help reduce ITS costs; and, perhaps most importantly, will in the near future be required in order to ensure continued use of Federal ITS funds.

2.1.1 Architecture Development Process

The process used to develop the Shreveport/Bossier City Regional ITS Architecture is illustrated in **Figure 2.1**. As shown in the figure, the development of the architecture begins with the identification of needs and “user services.” User Services articulate local transportation needs and problems in a structured and common vocabulary. User Services are a standardized definition of what must be provided in order for the ITS system to successfully meet user needs. The identification of user services leads to the selection of the market packages. A market package, as defined in the National ITS Architecture, is a “bundle” of technology services that is often purchased together as a group. Market packages are selected to provide the functions necessary to deploy the services. Where user services address the needs or “what” the issues are, market packages address “how” the needs or services are addressed. The relationships between the nationally defined user services and market packages have been established as part of the National ITS Architecture effort.

Table 2.1 Highlights of Federal ITS Architecture and Standards Rule/Policy

Requirement	Rule/Policy
Architecture Requirements	<ul style="list-style-type: none"> ▪ If a region has or is deploying ITS projects, a regional ITS architecture must be developed by April 8, 2005, which is four years from the effective date of the Rule and Policy. ▪ If a region has not yet deployed an ITS project, a regional ITS architecture must be developed within four years after its first ITS project deployment. ▪ <u>Modifications to existing systems in order to conform with the National ITS Architecture are not required by the Rule and Policy.</u> It is anticipated that over time, however, regional ITS architectures will call for changes in existing (legacy) systems in order to support local desires for integration. ▪ The regional architecture shall include, at a minimum, the following: <ol style="list-style-type: none"> 1. A description of the region; 2. Identification of participating agencies and other stakeholders; 3. An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture; 4. Any agreements (existing or new) required for operations, including at a minimum those affecting ITS project interoperability, utilization of ITS related standards, and the operation of the projects identified in the regional ITS architecture; 5. System functional requirements; 6. Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture); 7. Identification of ITS standards supporting regional and national interoperability; and 8. The sequence of projects required for implementation. <p>Prior to authorization of Highway Trust Funds, including Mass Transit Funds, for acquisition or implementation of ITS projects, compliance with the rule/policy must be demonstrated (in the case of the FTA Policy, it is specifically noted that grantees shall self-certify compliance). Compliance will be monitored under normal Federal-Aid and FTA oversight procedures (in the case of the FTA Policy, to include annual risk assessments, triennial reviews, and program management oversight reviews as applicable).</p>

Table 2.1 Highlights of Federal ITS Architecture and Standards Rule/Policy

Requirement	Rule/Policy
Project and Policy Requirements	<ul style="list-style-type: none"> ▪ Until a regional architecture is in place, all <i>major</i> ITS projects must have a <u>project level architecture</u> to ensure proper consideration of regional integration (a “major” ITS project is any ITS project that implements part of a regional ITS initiative that is multi-jurisdictional, multi-modal, or otherwise affects regional integration of systems.) ▪ Once a regional ITS architecture is in place, all subsequent ITS projects must be designed in accordance with the regional architecture (i.e. accommodate the interface requirements and information exchanges specified in that architecture). ▪ All ITS projects must be developed using a <u>systems engineering approach</u>. The systems engineering analysis shall include, at a minimum: <ul style="list-style-type: none"> ➤ Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS Architecture); ➤ Identification of participating agencies roles and responsibilities; ➤ Requirements definitions; ➤ Analysis of alternative system configurations and technology options to meet requirements; ➤ Procurement options; ➤ Identification of applicable ITS standards and testing procedures; and ➤ Procedures and resources necessary for operations and management of the system. ▪ The Final Rule/Policy requires that federally-funded ITS projects use ITS standards adopted by the USDOT. As of August 2001 no standards have been adopted, although over 80 ITS standards are in development, and many are published. As a standard matures and is utilized by vendors and implementers, USDOT may decide to adopt it through a separate formal rulemaking process. ▪ Any project that has advanced to final design by the effective date of the Final Policy/Rule (April 8, 2001) is exempt from the requirements relative to conformity to the regional architecture and use of standards. Some research projects and projects that entail an expansion of an ITS system in existence on the date of the enactment of TEA-21 may also be exempted from the Final Rule/Policy requirements.

The selection of market packages allows for the identification of equipment packages and subsystems – a collection of building blocks for the development of the physical architecture. The physical architecture is defined using a technical layer, which describes the high-level systems and subsystems. The architecture is then concluded with the discussion on National ITS standards and their implications to ITS deployment in the Shreveport/Bossier City region.

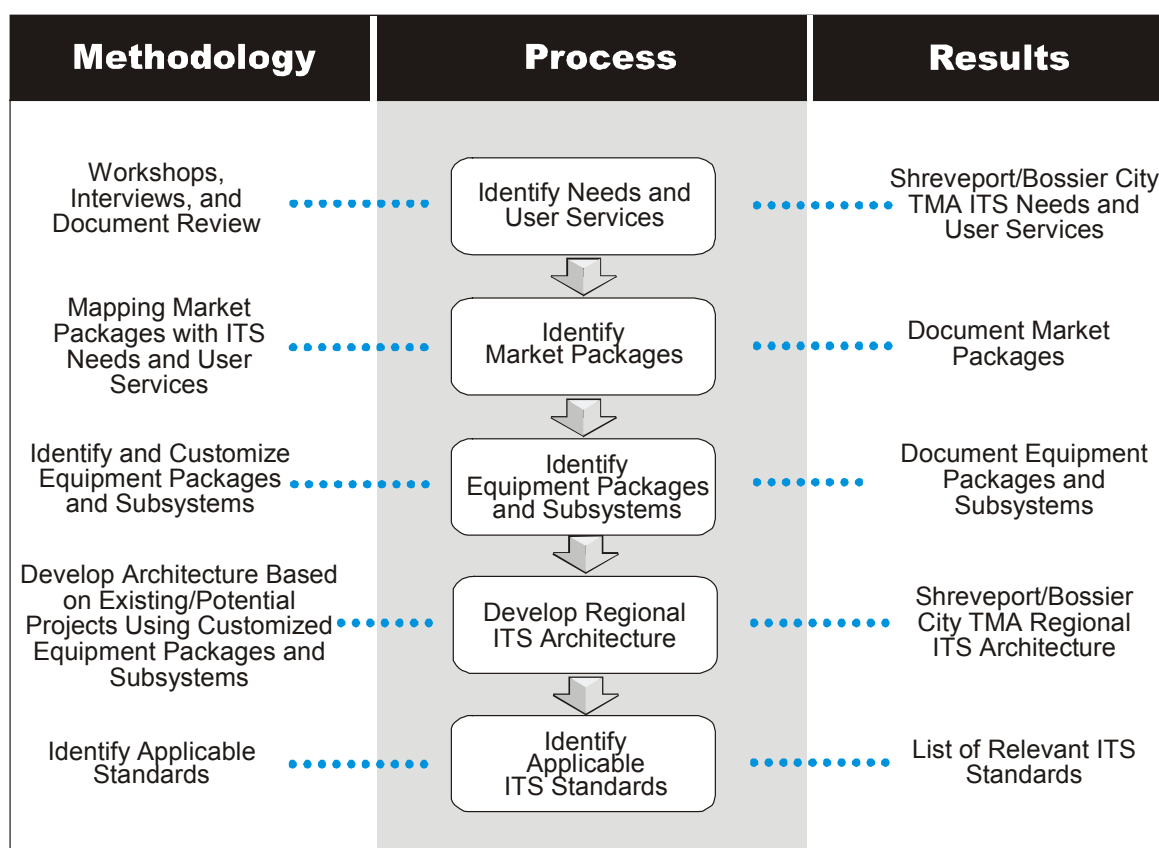


Figure 2.1 Architecture Development Process

2.2 User Services and Market Packages

The first two steps in the process to develop the Shreveport/Bossier City regional ITS architecture are to convert the local needs/problems into user services, and then select market packages that support the locally-applicable user services. Mapping of user needs to user services is an important step in architecture development. It converts the stated user needs into National ITS Architecture compliant languages that set the stage for the subsequent steps of architecture development.

The identification of local transportation needs/problems as well as the selection and prioritization of user services and market packages are summarized in *Appendix B Prioritization of ITS User Services and Market Packages*. **Table 2.2** lists the twenty-one Primary Market Packages for the Shreveport/Bossier City region as identified in the selection and prioritization process.

Table 2.2 Shreveport/Bossier City Region Primary Market Packages

Market Package Category	Market Package	
Advanced Public Transportation Systems (APTS)	APTS1 APTS2 APTS3 APTS5 APTS8	Transit Vehicle Tracking Transit Fixed-Route Operations Demand Response Transit Operations Transit Security Transit Traveler Information
Advanced Traveler Information Systems (ATIS)	ATIS1	Broadcast Traveler Information
Advanced Traffic Management Systems (ATMS)	ATMS1 ATMS3 ATMS4 ATMS6 ATMS7 ATMS8 ATMS11 ATMS13 ATMS14 ATMS15 ATMS18	Network Surveillance Surface Street Control Freeway Control Traffic Information Dissemination Regional Traffic Control Incident Management System Emissions Monitoring and Management Standard Railroad Grade Crossing Advanced Railroad Grade Crossing Railroad Operations Coordination Road Weather Information System
Emergency Management (EM)	EM1 EM2 EM3	Emergency Response Emergency Routing Mayday Support
Archived Data (AD)	AD1	ITS Data Mart

2.3 Subsystems and Equipment Packages

This section summarizes the system functional requirements for the Shreveport/Bossier City regional ITS components in terms of market packages, subsystems, and equipment packages. A market package is implemented with a combination of interrelated equipment; this equipment often resides in several different subsystems within the architecture framework and may be operated by different stakeholders. For instance, the Transit Vehicle Tracking market package includes vehicle location equipment in the Transit Vehicle Subsystem and a base station element in the Transit Management Subsystem. In this example, all market package elements are owned and operated by the same transit stakeholder.

In other cases, the market package elements are owned and operated by different stakeholders. Many of the ATIS market packages require equipment in the Information Service Provider Subsystem that is owned and operated by a public or private information provider and equipment that is acquired and operated by the consumer as part of the Vehicle Subsystem or Personal Information Access Subsystem. Since equipment in different subsystems may be purchased and operated by different end-users, these subsystem-specific components may encounter varied deployment.

To understand and analyze these potential deployment variations, the defined market packages must be decomposed to their constituent elements. The portion of the market package capabilities that are allocated to each subsystem are segregated and defined as equipment packages to support this additional resolution. An equipment package represents a set of equipment/capabilities that are likely to be purchased by an end-user as a component to an overall system.

This section will use the list of primary market packages selected for the Shreveport/Bossier City region to identify the subsystems that are critical in developing a regional ITS architecture and to identify the equipment packages that make up the market packages.

2.3.1 Mapping of Market Packages to Subsystems and Equipment Packages

Table 2.3 illustrates the process used to map the primary market packages to subsystems and equipment packages. This table provides the selected Shreveport/Bossier City regional market packages, the subsystems that are part of the market packages and the equipment packages that make up the market packages. As indicated in the table, the architecture provides a means to map the market packages to appropriate subsystems (components) and equipment packages (technology).

The above table allows for the identification of subsystems and equipment packages that are appropriate for the implementation of ITS projects in the Shreveport/Bossier City region. For detailed definitions of all available subsystems and equipment packages, please consult the National ITS Architecture CD-ROM or web site (www.odetics.com/itsarch). The identification of subsystems applicable to the Shreveport/Bossier City region provides a systematic approach to the development of an ITS architecture. The subsystems that are defined in *Table 2.3* were used as the basis for the development of the physical architecture which provides an overview of the systems that are and will be deployed in the Shreveport/Bossier City region.

2.4 System Architecture

An ITS Architecture provides a common structure for the design of intelligent transportation systems. It is not a system design nor is it a design concept. What it does, is define the framework around which multiple design approaches can be developed, each one specifically tailored to meet the individual needs of the user, while maintaining the benefits of a common architecture. An ITS architecture defines the functions (e.g., gather traffic information or request a route) that must be performed to implement a given user service, the physical entities or subsystems where these functions reside (e.g., the roadside or the vehicle), the

interfaces/information flows between the physical subsystems, and the communication requirements for the information flows (e.g., wireline or wireless). In addition, it identifies and specifies the requirements for the standards needed to support national and regional interoperability, as well as product standards needed to support economy-of-scale considerations in deployment. An ITS architecture provides a framework for delivering the selected market packages by identifying the major components of the system, referred to as subsystems, and how these subsystems relate to each other, including what data will be communicated between subsystems.

Table 2.3 Shreveport/Bossier City Region Market Packages, Subsystems and Equipment Packages

Market Package	Subsystem	Equipment Package
Network Surveillance (ATMS1)	Roadway	Roadway Basic Surveillance
	Traffic Management	Collect Traffic Surveillance Traffic Maintenance
Surface Street Control (ATMS3)	Roadway	Roadway Signal Controls
	Traffic Management	TMC Signal Control Traffic Maintenance
Freeway Control (ATMS4)	Roadway	Roadway Freeway Control
	Traffic Management	TMC Freeway Management Traffic Maintenance
Traffic Information Dissemination (ATMS6)	Roadway	Roadway Traffic Information Dissemination
	Traffic Management	TMC Traffic Information Dissemination
Regional Traffic Control (ATMS7)	Traffic Management	TMC Regional Traffic Control
Incident Management System (ATMS8)	Emergency Management	Emergency Response Management
	Roadway	Roadway Incident Detection
	Traffic Management	TMC Incident Detection TMC Incident Dispatch Coordination/Communication
Emissions Monitoring and Management (ATMS11)	Emissions Management	Emissions Data Management
	Roadway	Roadway Emissions Monitoring
Standard Railroad Grade Crossing (ATMS13)	Roadway	Standard Rail Crossing
	Traffic Management	HRI Traffic Management
Advanced Railroad Grade Crossing (ATMS14)	Roadway	Advanced Rail Crossing
	Traffic Management	HRI Traffic Management
Railroad Operations Coordination (ATMS15)	Traffic Management	Railroad Operations Coordination
Road Weather Information System (ATMS18)	Roadway	Roadway Environment Monitoring
	Traffic Management	TMC Road Weather Monitoring
Broadcast Traveler Information (ATIS1)	Information Service Provider	Basic Information Broadcast
	Personal Information Access	Personal Basic Information Reception
	Remote Traveler Support	Remote Basic Information Reception
	Vehicle	Basic Vehicle Reception
Transit Vehicle Tracking (APTS1)	Transit Management	Transit Center Tracking & Dispatch
	Transit Vehicle	On-board Transit Trip Monitoring
	Vehicle	Vehicle Location Determination

Table 2.3 Shreveport/Bossier City Region Market Packages, Subsystems and Equipment Packages

Market Package	Subsystem	Equipment Package
Transit Fixed Route Operations (APTS2)	Transit Management	Transit Center Fixed-route Operations Transit Garage Operations
	Transit Vehicle	On-board Fixed-route Schedule Management
Demand Response Transit Operations (APTS3)	Transit Management	Transit Center Paratransit Operations Transit Garage Operations
	Transit Vehicle	On-board Paratransit Operations
Transit Security (APTS5)	Remote Traveler Support	Remote Mayday I/F Secure Area Monitoring
	Transit Management	Transit Center Security
	Transit Vehicle	On-board Transit Security
Transit Traveler Information (APTS8)	Remote Traveler Support	Remote Transit Information Services
	Transit Management	Transit Center Information Services
	Transit Vehicle	On-board Transit Information Services
Emergency Response (EM1)	Emergency Management	Emergency Call Taking Emergency Response Management
	Emergency Vehicle	On-board EV Incident Management Communication
Emergency Routing (EM2)	Emergency Management	Emergency Dispatch
	Emergency Vehicle	On-board EV En Route Support
	Roadway	Roadside Signal Priority
	Vehicle	Vehicle Location Determination
Mayday Support (EM3)	Emergency Management	Mayday Support
	Personal Information Access	Personal Location Determination Personal Mayday I/F
	Remote Traveler Support	Remote Mayday I/F
	Vehicle	Vehicle Location Determination Vehicle Mayday I/F
ITS Data Mart (AD1)	Archived Data Management	Government Reporting Systems Support ITS Data Repository Traffic and Roadside Data Archival
	Emergency Management	Emergency Data Collection
	Information Service Provider	ISP Data Collection
	Roadway	Roadside Data Collection
	Traffic Management	Traffic Data Collection
	Transit Management	Transit Data Collection

The Shreveport/Bossier City regional ITS architecture was developed from a high-level physical architecture perspective. The physical perspective describes an architecture, which coordinates overall system operations by defining interfaces between equipment, and systems, which may be deployed by different organizational or operating agencies throughout the Shreveport/Bossier City region.

2.4.1 Physical Architecture

A physical architecture is a graphical representation of the ITS “system.” The physical architecture provides agencies with a physical representation (though not a detailed design) of the important ITS interfaces and major system components. The principal elements in the physical architecture are the 19 subsystems defined in the National ITS Architecture and the architecture flows that connect these subsystems and terminators into an overall structure. A physical architecture takes the processes identified in the logical architecture and assigns them to subsystems. It further identifies the system terminator inputs (sources) and system terminator outputs (destinations) for architecture flows into and out of the system. In addition, the data flows (from the logical architecture) are grouped together into architecture flows. These architecture flows and their communication requirements define the interfaces required between subsystems, which form the basis for much of the ongoing standards work in the ITS program.

The physical architecture includes the various transportation-related processing centers, roadside equipment, vehicle equipment, and other equipment used by the traveler to access the multitude of ITS services. It coordinates overall system operations by defining interfaces between equipment and systems, which may be deployed by different organizational or operating agencies in the Shreveport/Bossier City region. Furthermore, the physical architecture framework defines what major transportation system elements do and how they interact to provide the user needs for the Shreveport/Bossier City region.

Figure 2.2 presents the Shreveport/Bossier City regional ITS architecture. This architecture represents a regional view of the ITS implementation without taking into account who/what organization would be responsible for implementing all of the ITS systems. This architecture presents the “big picture” for the Shreveport/Bossier City region with regards to implementation. The subsystems included in the architecture are described below.

Travelers

The development and deployment of traveler information systems is a prime area for private sector involvement. While the public sector is well equipped for the development and management of the infrastructure (roadways, traffic management, etc.), the private sector is well suited for the development of products to use the information collected by the public sector and provide the information to the traveling public. The two main subsystems that are recommended for the Shreveport/Bossier City regional ITS architecture under the traveler subsystems are described below.

Remote Traveler Support

Transit and Traveler Information: This system provides traveler information through a broadcast mechanism. This could include providing transit users with real-time travel-related information at transit stops, multi-modal transfer points, and other public transportation areas. It provides transit users with the latest available information on transit routes, schedules, transfer options, fares, real-time schedule adherence, current incidents, weather conditions, and special events.

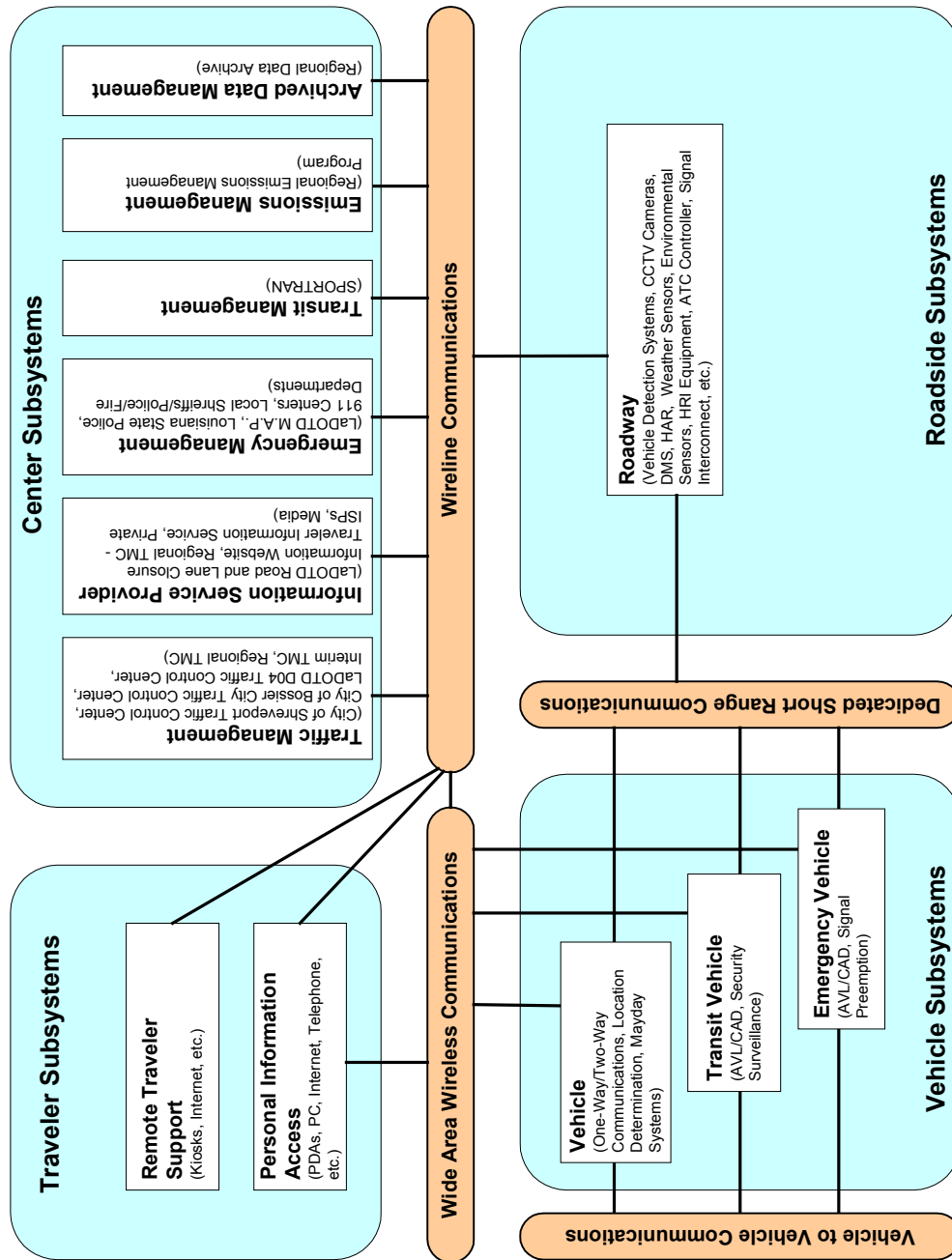


Figure 2.2 Shreveport/Bossier City Regional System Architecture

Personal Information Access

Web Based Transit and Traveler Information: Currently DOTD provides information on construction and maintenance work as well as road conditions via its website. It is planned to develop and further enhance internet-based information regarding travel time, congestion, and incidents, along with transit schedules and route information. The Internet is an effective traveler information tool and it can be personalized to receive specific traveler information based on selected routes.

Media: Included separately, the interfaces with the media include electronic interfaces such as internet service providers, radio and TV stations as well as interfaces with the print media in the region. Though not real-time, the print media can provide a valuable source of information dissemination to the general public about known traffic and travel conditions. This can be of particular benefit in the dissemination of traffic information regarding planned events, such as road construction and closure, or special events.

Centers

Traffic Management

DOTD District 04: DOTD currently performs some traffic management activities on state highways within the region. The district office also plays major roles in planning and the regional coordination effort. Planned ITS activities include (1) sharing control and operations between the District, City of Shreveport, and City of Bossier City with possible links to the State Police; and (2) deployment of a dynamic message sign (DMS) system, radar vehicle detection (RVD) system, CCTV cameras, highway advisory radio (HAR) and motorist assistance program (MAP) on controlled-access highways.

City of Shreveport: The City of Shreveport already performs some traffic management functions. Planned activities include upgrades or replacement of traffic signal system components (controllers and interconnect) and expansion of the legacy traffic signal system.

City of Bossier City: The City of Bossier City operates closed-loop signal systems within its jurisdiction. Planned near-term improvements include the installation of interconnect and rail crossing preemption.

Interim Transportation Management Center (ITMC): ITMC components are currently planned to be located at the existing DOTD District 04 office (3339 Industrial Drive, Bossier City) and the existing City of Shreveport Traffic Engineering office (2123 Lakeshore Drive, Shreveport). The ITMC operations will be coordinated between DOTD District 04 and the City of Shreveport. The ITMCs will perform traffic management functions and support maintenance and operations in the near-term.

Regional Transportation Management Center (RTMC): The RTMC is currently envisioned at the site of the existing DOTD District 04 office. It will provide centralized regional traffic control on freeways and arterials with active participation from DOTD, NLCOG, City of Shreveport, City of Bossier City, and the Louisiana State Police. The RTMC will be responsible for managing, collecting, processing and distributing traffic data. This center will also be responsible for disseminating traveler information either through roadside devices or to an Information Service Provider.

Emergency Management

Motorist Assistance Patrol (MAP): The Motorist Assistance Patrol (MAP) is an existing service of the DOTD, which reduces traffic congestion caused by vehicle breakdowns while providing assistance to motorists.

Other agencies that perform emergency management and response functions within the region may include:

- *Louisiana State Police*
- *Parish 911 Centers*
- *Sheriff's Departments*
- *Local Police Departments*
- *Fire Departments*
- *Emergency Medical Services*

Information Service Provider

RTMC: The RTMC will collect transportation information from public agencies within the region and disseminate the information to the traveling public via its roadside infrastructure. The RTMC or a separate entity may serve as an information service provider (ISP) to disseminate real time and static traveler information to the public via methods such as websites, telephone answering points, personal data assistants (PDAs), kiosks, etc.

Private Information Service Providers: Private ISPs may also be involved in providing transportation information to the public. Public information may be available through a variety of sources, including Internet, PDAs, kiosks, and other enhanced methods supported by independent service providers.

Transit Management

SPORTRAN: SPORTRAN is the major transit system in the Shreveport/Bossier City region, providing fixed-route bus services as well as demand-respond paratransit services. SPORTRAN currently performs advanced transit management functions using ITS technologies such as computer aided dispatch (CAD) and automatic vehicle location (AVL). Planned ITS activities include:

- Provide enhanced transit schedule management.

- Real-time transit information dissemination through on-board information system, traveler information terminals/kiosks at bus stops, and/or transit information website.
- Improve transit security by improving surveillance and monitoring of transit vehicles and facilities.

Emissions Management

An emissions management subsystem will provide the capabilities for air quality monitoring and management. The emissions management subsystem will provide emissions data, air quality and pollution information to the RTMC for implementing strategies that are intended to reduce emissions in and around the problem areas.

Archive Data Management

The Archive Data Management Subsystem collects, archives, manages, and distributes data generated from ITS sources. These data can then be used in transportation administration, policy evaluation, safety, planning, performance monitoring, program assessment, operations, and research applications. In the Shreveport/Bossier City region, data archiving is currently envisioned as a joint effort of several agencies, with the lead by DOTD and/or NLCOG. Partnership arrangement among agencies may be established to provide enhanced data archiving functions to individual agencies as well as to the region as a whole.

Roadside

Roadway

Current closed-loop systems in the Cities of Shreveport and Bossier City will be upgraded. The planned improvements include upgrading the systems to equip with ATC controllers, video detection capabilities, and fiber interconnect on all primary arterials. Radar vehicle detectors, CCTV cameras, DMS, and HAR will be deployed on controlled-access highways and critical locations within the region.

Vehicles

Vehicle

Vehicles may equip with one-way or two-way communications options, in-vehicle navigation systems, vehicle location determination technologies, and Mayday systems (e.g. On-Star, etc.).

Transit Vehicle

This includes advanced technologies such as AVL/CAD, transit vehicle tracking sensors, on-board schedule management, on-board transit information, and transit vehicle surveillance and security monitoring.

Emergency Vehicle

This includes functions that deal with regular and HAZMAT incident response and clearance, emergency routing, on-board incident management communications, and signal preemption. Emergency management agencies will implement CAD/AVL systems to interact with the emergency management centers for advanced automatic vehicle operation for emergency routing, incident responses and clearance.

2.5 National ITS Standards

ITS Standards are fundamental to the establishment of an open ITS environment that achieves the goals originally envisioned by the U.S. Department of Transportation. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve.

Standards can be thought of as the glue that pulls various pieces of the architecture together. The logical architecture presents a functional view of the ITS user services. It defines the functions or processes that are required to perform the selected ITS user services, and the information or data flows that need to be exchanged between these functions. The physical architecture partitions the functions defined by the logical architecture into systems and subsystems. To accomplish the functions outlined in the logical architecture, communication must take place between the elements of the physical architecture. Standards define how these communications take place.

2.5.1 Standards Benefits

Many of the benefits the public receives from the National ITS Architecture are a direct result of the development and implementation of standards. Primarily, standards provide benefits in the following areas:

- **National Compatibility** – National compatibility is represented by the ability to use the same equipment and services, regardless of the geographical location.
- **Multiple Suppliers** – The architecture can encourage competition in the delivery of ITS services through the implementation of standards in areas where a standard is not necessarily required to provide a traveler with seamless operation of his ITS service.
- **Ranges of Functionality** – The standard packages contain data flows that support several levels of service. For example, the *trip plan* data flow contains a large number of optional data fields. The standards developer is encouraged to maintain the flexibility in the data flow specifications to allow for multiple implementations.
- **Synergy** – As discussed above, the architecture began with a logical architecture that satisfied the identified user services. As a result, there are functions and data flows

common to several of the services. These “processes” appear in several higher level data flows, and because they come from a single source they support synergy and consistency.

- **Risk Reduction** – The architecture reduces risk to public providers, private providers and consumers. For public providers, existence of standards means that equipment purchased one year will likely operate with new equipment purchased several years from now. This also means that agencies will not be locked into specific vendors since all vendors will be able to build to the same standard. For private providers, existence of standards means that they can gather information from multiple sources using well-defined message sets and thereby increase the level of service to their customers. For consumers, products built to a particular standard will allow a user to select their service provider from a number of companies, not just the company that their equipment happens to be compatible with.

Defined standards are fundamental to the establishment of nationally compatible and interoperable ITS deployments. Standards will enable deployment of consistent, non-interfering, reliable systems on local, regional and national levels. Open standards will further benefit the consumer by enhancing competition for the range of products necessary to implement the ITS user services. Larger markets for specific products will reduce production costs through economy of scale. Producers benefit from standards because they assure a wide market over which the product can be sold. As deployment occurs, diverse systems will be developed to address the special needs of urban, suburban and rural environments. Standards must ensure interoperability across these implementations without impeding innovation.

2.5.2 Recommended Standards for Shreveport/Bossier City Region

More than ninety standards have been identified as part of the National ITS architecture standard development activities. The task of working with public and private sector ITS community to develop these standards has been tasked to seven different standards development organizations (SDOs). These SDOs include:

- American Association of State Highway and Transportation Officials (AASHTO)
- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Institute of Electrical and Electronics Engineers (IEEE)
- Institute of Transportation Engineers (ITE)
- National Electrical Manufacturers Association (NEMA)
- Society of Automotive Engineers (SAE)

While the Shreveport/Bossier City Regional ITS Program includes various ITS applications, it does not cover every conceivable ITS technology. As such, not all ITS standards will be applicable to the proposed ITS projects. **Table 2.4** identifies the ITS standards that are relevant to the Shreveport/Bossier City region. The table identifies all architecture flows that are used in the Shreveport/Bossier City regional architecture that are supported by ITS standards.

Table 2.4 ITS Standards Relevant to the Shreveport/Bossier City Regional ITS Architecture

Lead SDO	Standard Name	Document ID	Status*
AASHTO	Simple Transportation Management Framework (STMF)	NTCIP 1101	P
AASHTO	Base Standard: Octet Encoding Rules (OER)	NTCIP 1102	B
AASHTO	Simple Transportation Management Protocol (STMP)	NTCIP 1103	U
AASHTO	Global Object Definitions	NTCIP 1201	P
AASHTO	Object Definitions for Actuated Traffic Signal Controller Units	NTCIP 1202	P
AASHTO	Object Definitions for Dynamic Message Signs	NTCIP 1203	P
AASHTO	Object Definitions for Environmental Sensor Stations & Roadside Weather Information System	NTCIP 1204	P
AASHTO	Data Dictionary for Closed Circuit Television (CCTV)	NTCIP 1205	A
AASHTO	Object Definitions for Data Collection	NTCIP 1206	B
AASHTO	Ramp Meter Controller Objects	NTCIP 1207	A
AASHTO	Object Definitions for Video Switches	NTCIP 1208	U
AASHTO	Object Definitions for Transportation Sensor System	NTCIP 1209	B
AASHTO	Objects for Signal Systems Master	NTCIP 1210	U
AASHTO	Objects for Signal Control Priority	NTCIP 1211	U
AASHTO	Weather Report Message Set for ESS	NTCIP 1301	U
AASHTO	Class B Profile	NTCIP 2001	P
AASHTO	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile	NTCIP 2101	A
AASHTO	Subnetwork Profile for PMPP using FSK Modems	NTCIP 2102	B
AASHTO	Subnet Profile for Point-to-Point Protocol using RS 232	NTCIP 2103	B
AASHTO	Subnetwork Profile for Ethernet	NTCIP 2104	B
AASHTO	Transportation Transport Profile	NTCIP 2201	B
AASHTO	Internet (TCP/IP and UDP/IP) Transport Profile	NTCIP 2202	A
AASHTO	Application Profile for Simple Transportation Management Framework (STMF)	NTCIP 2301	A
AASHTO	Application Profile for Trivial File Transfer Protocol	NTCIP 2302	A
AASHTO	Application Profile for File Transfer Protocol (FTP)	NTCIP 2303	A
AASHTO	Application Profile for Data Exchange ASN.1 (DATEX)	NTCIP 2304	B
AASHTO	Application Profile for Common Object Request Broker Architecture (CORBA)	NTCIP 2305	U
AASHTO	Information Profile for DATEX	NTCIP 2501	U
AASHTO	Information Profile for CORBA	NTCIP 2502	U
ASTM	ADMS Standard Guidelines	ASTM AG	U
ASTM	ADMS Data Dictionary Specifications	ASTM DD	U
ASTM	Standard Specification for 5.9 GHz Data Link Layer	ASTM N/A	U

Table 2.4 ITS Standards Relevant to the Shreveport/Bossier City Regional ITS Architecture

Lead SDO	Standard Name	Document ID	Status*
ASTM	Standard Specification for 5.9 GHz Physical Layer	ASTM N/A	U
ASTM	Specification for Dedicated Short Range Communication (DSRC) Data Link Layer: Medium Access and Logical Link Control	ASTM PS 105-99	P
ASTM	Specification for Dedicated Short Range Communication (DSRC) Physical Layer using Microwave in the 902-928 MHz	ASTM PS 111-98	P
EIA/CEA	Data Radio Channel (DARC) System	CEA/EIA-794	P
EIA/CEA	Subcarrier Traffic Information Channel (STIC) System	CEA/EIA-795	P
IEEE	Standard for Traffic Incident Management Message Sets for Use by EMCs	IEEE P1512.1	U
IEEE	Standard for Public Safety IMMS for Use by EMCs	IEEE P1512.2	U
IEEE	Standard for Emergency Management Data Dictionary	IEEE P1512.a	U
IEEE	Standard for Common Incident Management Message Sets (IMMS) for Use by EMCs	IEEE P1512-2000	P
IEEE	Security/Privacy of Vehicle/RS Communications including Smart Card Communications	IEEE P1556	U
ITE	Standard for Functional Level Traffic Management Data Dictionary (TMDD)	ITE TM 1.03	B
ITE	Message Sets for External TMC Communication (MS/ETMCC)	ITE TM 2.01	B
ITE	TCIP - Common Public Transportation (CPT) Business Area Standard	NTCIP 1401	P
ITE	TCIP - Incident Management (IM) Business Area Standard	NTCIP 1402	P
ITE	TCIP - Passenger Information (PI) Business Area Standard	NTCIP 1403	P
ITE	TCIP - Scheduling/Runcutting (SCH) Business Area Standard	NTCIP 1404	P
ITE	TCIP - Spatial Representation (SP) Business Area Standard	NTCIP 1405	P
ITE	TCIP - Onboard (OB) Business Area Standard	NTCIP 1406	P
ITE	TCIP - Control Center (CC) Business Area Standard	NTCIP 1407	P
SAE	ISP-Vehicle Location Referencing Standard	SAE J1746	P
SAE	On-Board Land Vehicle Mayday Reporting Interface	SAE J2313	P
SAE	Data Dictionary for Advanced Traveler Information System (ATIS)	SAE J2353	P
SAE	Message Set for Advanced Traveler Information System (ATIS)	SAE J2354	P
SAE	Standard for Navigation and Route Guidance Function Accessibility While Driving	SAE J2364	B
SAE	Standard for ATIS Message Sets Delivered Over Bandwidth Restricted Media	SAE J2369	P
SAE	ITS In-Vehicle Message Priority	SAE J2395	A

Table 2.4 ITS Standards Relevant to the Shreveport/Bossier City Regional ITS Architecture

Lead SDO	Standard Name	Document ID	Status*
SAE	Measurement of Driver Visual Behavior Using Video Based Methods (Def. & Meas.)	SAE J2396	P
SAE	Adaptive Cruise Control: Operating Characteristics and User Interface	SAE J2399	B
SAE	Forward Collision Warning: Operating Characteristics and User Interface	SAE J2400	U
SAE	Rules for Standardizing Street Names and Route IDs	SAE J2529	B
SAE	Messages for Handling Strings and Look-Up Tables in ATIS Standards	SAE J2540	A

***Status (as of December 31, 2001):** P—Published A—Approved
 B—In Ballot U—Under Development

2.6 Expansion and Refinement of the Regional System Architecture

An ITS system architecture is, like any regional planning tool, an evolving product that will be revised over time, especially so since ITS is relatively new to most agencies and involves new and still changing technologies and institutional relationships. The USDOT approach to architecture reflects this evolving, flexible nature.

The ITS architecture for the Shreveport/Bossier City region that was presented in the preceding sections includes preliminary versions of a number of elements that will be required by the USDOT to be included in all regional ITS architectures by April 2005. These elements include an identification of existing and planned ITS elements and stakeholders, the subsystems to be included in the system architecture, market packages, and connections between the RTMC and various other regional ITS elements. However, over the next several years as the implementation of ITS infrastructure advances and as the supporting institutional relationships are further developed, it will be important to expand and revise the preliminary architecture that is presented here.

Neither the FHWA nor the FTA have identified any specific plans to check regional architectures for compliance, but after April 2005, as part of the review of Federally-funded ITS projects, regional architectures will be under some scrutiny. In the Shreveport/Bossier City region, it is appropriate to consider additional architecture development effort in several areas, building upon the core architecture that has been developed, and reflecting the evolution of the regional ITS effort that will occur over the next several years:

- **Operational Concept**—an operational concept identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture. Through activities such as stakeholder interviews and work sessions, the Shreveport/Bossier City region has developed the core

of the regional operational concept. In the future, as the role of the stakeholders is clearly defined, this information should be reflected in the architecture.

- **Agreements**—a regional ITS architecture is to include any agreements required for operations, including at a minimum those affecting ITS interoperability, utilization of ITS related standards, and the operation of the projects identified in the regional architecture. As the regional ITS operational concept is expanded, and as agencies develop agreements to support their role in operations, these agreements should be reflected in the architecture.
- **Interface Requirements**—a regional ITS architecture is to include interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture). As presented in this report, a high-level interconnect diagram has been developed identifying, in concept, the connections between the RTMC and various other regional ITS elements. In the future, these connections should be further described.
- **Standards**—a regional ITS architecture is to identify ITS standards supporting regional and national interoperability. Currently, the USDOT has not formally adopted any of the ITS standards that have been developed. However, as regional ITS implementation and operations proceed, the role of identified and emerging ITS standards should be considered, on a regional basis. As standards related policies emerge, they should be documented in the regional architecture.

2.7 Development of Regional ITS Architecture Consistency Process

In order to expedite future federal ITS project funding, it is recommended that the Shreveport/Bossier City region consider development of a process to insure that, prior to federal funding requests, the relationship between specific local ITS projects and the regional ITS architecture is identified. This section identifies the direction that has been provided by the FHWA and FTA, and identifies considerations relative to developing an architecture consistency process for the Shreveport/Bossier City region.

2.7.1 Federal Architecture Consistency Direction

The FHWA rule and FTA policy on ITS architecture and standards does not mandate a specific local process, or local agency roles, in ensuring that Federally-funded ITS projects comply with the rule/policy. The rule/policy merely states that: (1) compliance will be self-certified by federal funding grantees, and (2) that monitoring of compliance will be done as part of normal oversight by FHWA/FTA.

The first Federal guidance document on compliance with the architecture rule/policy was issued by the FTA as a “working document” in October 2001 (the document is in the process of being issued as an FTA Circular). That document, *FTA National ITS Architecture Consistency Policy*

for Transit Projects, includes much useful information on overall roles and responsibilities. The report also includes additional information on the self-certification process to be followed by federal ITS fund grantees and the oversight process to be followed by the FTA. Although some of the guidance in the FTA document will apply only to FTA projects, much of the information will either also directly apply to FHWA projects, or is useful in identifying the general direction that will likely be taken by the FHWA. (The FHWA is currently working on an overall guidance document for developing, using, and maintaining regional architectures, but does not have a document equivalent to the FTA project-level guidance).

The following highlights the guidance presented in the FTA working document on architecture consistency for transit projects:

- Overall, grantee self-certification will follow the procedures and requirements established in the “FTA Master Agreement”, and the “Annual List of Certifications and Assurances for Federal Transit Administration Grants and Cooperative Agreements”.
- In general, the Federal Role is to offer guidance and assistance on meeting the Architecture conformity requirements, though some oversight integrated with the normal FTA oversight procedures will also be carried out. The transit agency/grantee is responsible for working with its regional partners to develop a regional architecture and meet the other project level requirements (e.g. agreements, systems engineering analysis).
- ITS projects should be accounted for in FTA grant applications and procedures as the regional ITS architecture is developed and the projects move from planning to development and finally implementation. This includes:
 - Accounting for the Policy and other requirements in the FTA self certification, annual assurances and certifications, and Cooperative Agreements.
 - Incorporating Transit ITS activities into the Metropolitan Planning Program Grants and Urban Planning Work Program (UPWP) process.
 - Including Transit ITS in the Transportation Plan (LRP), Transportation Improvement Program (TIP) and Statewide Transportation Improvement Program (STIP).
 - Documenting ITS projects and the status of policy conformity in FTA grant applications using TEAM.
 - Addressing Transit ITS in other Federal processes/requirements including the FTA Major Transit Investment (New Start) Process, the Congestion Mitigation and Air Quality (CMAQ) Program, the annual Federal ITS Service-Plan, and ITS Deployment Program Earmarks.
- A separate memorandum describing capturing ITS projects within TEAM (Transportation Electronic Award and Management) has been prepared and should be consulted for detailed guidance. In summary, grantees are expected to self-certify

compliance with all requirements for ITS Architecture Conformity as described in TEA-21 and the FTA Policy, including status relative to conformity with a regional architecture and the type of ITS to be implemented: ITS Fleet Management, ITS Electronic Fare Payment, ITS Traveler Information, or ITS Architecture Development.

- There are several FTA/FHWA programs that are likely to fund ITS projects and/or activities with specific procedures or regulations in addition to the general grant application requirements found in TEAM. These include:
 - Section 5309 Capital Grants, especially FTA Major Investment (New Start) Projects. It is important that the benefits and costs of the ITS elements be incorporated into the criteria calculation, the financial analysis, and the ability to implement and operate the ITS systems be part of the project management plan and PMO review. Transit agencies must work to fulfill both the New Start and ITS Conformity requirements for these projects. FTA Regional Offices must work to make agencies aware of the requirements, and to identify ITS elements within proposed New Start project early in their development.
 - The Congestion Mitigation and Air Quality (CMAQ) program.
 - The ITS Integration Program. Once the earmarks have been made, each year specific guidelines are also issued by FTA/FHWA on how they should be further defined and submitted for approval.
- Overall, the level of detail in documenting compliance with the Policy, and the level of oversight to be conducted by FTA, will vary depending on the scope of the ITS project. A major ITS project that requires the cooperation, agreement, sharing of information and data, and coordinated operations of several agencies will require much more analysis and supporting documentation, and will receive more oversight than one that is implemented within a single agency for its own use. Examples of efforts that may need more development, documentation, and analysis include:
 - A corridor or regional Transit Signal Priority System that operates in several municipalities, and on routes used by more than one agency;
 - An electronic payment system that will provide the first part of a regional electronic fare system, and later an integrated transportation payment system (tolls, parking and transit, etc.); and
 - A coordinated communication backbone and radio system for the region that will provide shared communications for transit agencies, emergency service providers, and public safety agencies.
- Examples of projects that must still meet the requirements, but may need less documentation are: a transit agency GIS and advanced scheduling system; an expansion of an existing AVL and computer-aided dispatch system by the single transit agency in the region; a vehicle maintenance, or station security system.

In addition to the above guidance, the FTA working document on architecture policy compliance identifies roles and responsibilities for major stakeholders, including the Federal Transit Administration, transit agencies/grantees, and other participants, including Metropolitan Planning Organizations. This information is presented in *Table 2.5*.

2.7.2 Shreveport/Bossier City Regional Architecture Consistency Process

As specified by the FHWA and FTA, whatever approach is taken in the Shreveport/Bossier City region in regard to ITS project consistency with the regional architecture will feature self-certification on the part of the project grantee. Although individual project sponsors will be required to demonstrate compliance, it is recommended that the Shreveport/Bossier City region consider development of a regional process that will facilitate that determination on behalf of individual project sponsors, and help ensure that the regional architecture remains viable as a planning tool. There are various approaches to such a process. One possible approach would feature either a Metropolitan Planning Organization (MPO) (i.e. NLCOG) or the DOTD District 04 as the facilitator, and would include the following four basic steps:

- 1) **Project grantee planning stage consultation MPO/DOTD**—the project sponsor or grantee first consults with the MPO/DOTD to determine:
 - a) Whether, and which of, the architecture rule/policy requirements apply:
 - Is it an ITS project?
 - Will it qualify for an exemption from the rule/policy?
 - Will Highway Trust Funds be utilized?
 - b) Is the project included in the regional ITS architecture, and if not, should the architecture be revised, and how?; and
 - c) Given the scale of the project, what is the appropriate approach to the systems engineering analysis?
- 2) **Development of federal funding grant application and supporting rule/policy compliance documentation**—after making the appropriate determinations in the planning consultation with the MPO/DOTD, the grantee will complete the federal funding grant application materials, including rule/policy compliance documentation. The MPO/DOTD will facilitate and assist in this process.
- 3) **Submittal of funding grant application.**

Table 2.5 ITS Architecture and Standards Rule/Policy Compliance: Stakeholder Roles and Responsibilities

Stakeholder	Roles and Responsibilities
Federal Transit Administration (Field and Headquarters)	<ul style="list-style-type: none"> • Become familiar with the Policy and its requirements • Establish roles, responsibilities, and communications channels among Regional staff, Headquarters, and other Federal partners (e.g. FHWA, FRA) for Policy support/oversight • Participate in applicable training • Ensure grantees, transit agencies, and other state and local entities: <ul style="list-style-type: none"> ➤ Are aware and knowledgeable of the Policy/Rule, its requirements, and FTA/FHWA processes for their implementation ➤ Understand the benefits of conformance with the ITS Architecture ➤ Are aware of appropriate training and other available resources • Provide support to grantees/transit agencies at the regional level of ITS development. <ul style="list-style-type: none"> ➤ Assist in assuring that grantees/transit agencies are aware of ITS activities in their region that may affect them. ➤ Help assure that grantees/transit agencies have the opportunity to participate in regional ITS architecture development and are represented in other Federal efforts (e.g. service plan development, ITS Deployment (Earmark) project definition) as appropriate. ➤ Provide coordination/facilitation among other grantees/transit agencies, State DOT's, other local operating entities, and other Federal offices as needed to ensure transit is represented, its interests are met and ITS regions are defined to account for transit service areas. ➤ Identify regions that are "at risk" and provide oversight and review of regional architecture development through the planning certification, risk assessment, and other Federal oversight activities • Provide support to grantees/transit agencies at the project level of ITS development. <ul style="list-style-type: none"> ➤ Assist grantees/transit agencies in resolving applicability of the Policy requirements. Is the project an ITS project or a Major ITS project? Do any of the applicability exceptions apply? What is the appropriate level of analysis and documentation? ➤ Provide assistance in awareness/coordination/facilitation of other ITS activities and architectures that impact the project (parallel major ITS projects, state and inter-urban travel corridor activities). ➤ Identify needs for oversight and technical assistance and training to successfully complete the project and conform to the Policy requirements. Assist in obtaining the required support. ➤ Incorporate ITS oversight in FTA oversight activities to help identify grantees/transit agencies that are at risk and ensure compliance with the Policy. Review TEAM applications and Section 5309 New Start development efforts for ITS content. Include ITS in annual risk assessments, quarterly project reviews, triennial reviews and other efforts • Commit adequate staffing to accomplish the above

Table 2.5 ITS Architecture and Standards Rule/Policy Compliance: Stakeholder Roles and Responsibilities

Stakeholder	Roles and Responsibilities
Transit Agency/Grantee	<ul style="list-style-type: none"> • Become familiar with the Policy and its requirements • Ensure that agency staff are trained as necessary to understand how to meet the Policy requirements and successfully implement/operate the ITS components within their systems. • Participate in regional ITS activities including the development of the regional ITS architecture. <ul style="list-style-type: none"> ➤ Work with all transit agencies and providers within the area to develop integrated and coordinated transit ITS systems as appropriate ➤ Participate in the development of the regional ITS architecture and it's inclusion of all transit ITS components ➤ Help define the ITS regional boundaries ➤ Adopt inter-agency agreements to ensure the successful implementation and operation of the regional ITS architecture • Meet the project level requirements of the Policy <ul style="list-style-type: none"> ➤ Identify the project's ITS elements and determine the Policy applicability (ITS Project, Major ITS Project, exempt). ➤ Identify portion's of the regional ITS architecture, or if a regional ITS architecture does not exist yet, the National ITS Architecture, that are applicable. Identify other overlapping state and inter-urban corridor architectures that may be relevant. ➤ Work to update architectures or develop a project architecture as appropriate. ➤ Perform a Systems Engineering Analysis on the ITS components of the project ➤ Include ITS project in TEAM grant submittal (description, and assurances) ➤ Adopt inter-agency agreements to ensure the successful implementation and operation of the project's ITS components • Commit adequate staffing to accomplish the above
Other Participants (e.g. MPO, State, other organizations)	<ul style="list-style-type: none"> • Become familiar with the Policy and its requirements • Participate in applicable training • Work with grantees/transit agencies, Federal participants, and others to: <ul style="list-style-type: none"> ➤ Determine regional boundaries acceptable to all stakeholders ➤ Integrate transit and other stakeholders into ITS development procedures ➤ Identify local champions and key participants for advancing/implementing ITS ➤ Identify roles and responsibilities for developing and maintaining the regional ITS architecture ➤ Develop and establish processes and procedures for creating and maintaining the regional ITS architecture ➤ Incorporate systems engineering analysis, ITS system sequencing, and need for agreements into project development and programming procedures ➤ Perform continuous process review to refine procedures • Commit adequate staffing to accomplish the above

Source: *FTA National ITS Architecture Consistency Policy for Transit Projects – Working Document*, October 2, 2001, Federal Transit Administration, pg. 6-8.

- 4) **Project grantee design stage consultation with MPO/DOTD**—once federal funding has been secured for the ITS project and the design of the project is underway, the grantee will again consult with the MPO/DOTD, to:
- Verify that the systems engineering process has been applied; and
 - Identify any changes in the project that have occurred since the planning consultation that warrant any changes to the regional architecture, or that warrant any other regional coordination.

Additional information on these possible regional ITS architecture consistency activities is included in *Appendix D*.

3.0 PROPOSED DEPLOYMENT

The proposed ITS deployment for the Shreveport/Bossier City region was determined through a series of meetings, work sessions, interviews, and close coordination with the region's stakeholders including:

- DOTD District 04 and Headquarters
- City of Bossier City
- City of Shreveport
- Northwest Louisiana Council of Governments
- Louisiana State Police
- SPORTRAN
- Transportation Incident Management Committee (TIMs)

3.1 Summary

The proposed deployment is generally consistent with the area's current and proposed future Congestion Management System (CMS) corridors and is intended to address transportation system deficiencies within the region. The deployment is grouped into timeframes (Immediate, Near, and Mid-Long) and phases to reflect the stakeholders' implementation priorities without consideration of potential funding constraints (i.e. the deployment is unconstrained). Detailed deployment information is contained in **Tables 3.1** and **3.2** followed by the cost basis in **Table 3.3**. A concise summary of the proposed deployment, grouped by timeframe and phase, is presented in **Table 3.4**. The Transit ITS Deployment Program, based on the ITS Architecture and meetings with SPORTRAN is summarized separately in **Table 3.5**. **Figures 3.1** through **3.4** graphically illustrate the proposed non-transit deployment.

Objectives of the proposed ITS deployment are to:

1. Improve traffic flow on the arterial street system within the region and address the outdated/antiquated traffic signal control system in the City of Shreveport, while integrating the Bossier City traffic signal control system.
2. Reduce existing and projected interstate congestion, with specific emphasis on reducing non-recurring congestion impact on the interstate.
3. Improving Incident Management through more effectively detecting, verifying, responding and clearing incidents.
4. Improving safety on the transportation system within the region.
5. Provide real time information to travelers regarding congestion, incidents, work zones and roadway conditions.

6. Improve transit bus operations by providing real time bus status information to transit users, and improving security on buses.

The ITS strategies to be deployed include:

- Advanced Surface Street Control with regional traffic control (including upgrade of all traffic signal systems within the City of Shreveport and integration of the Bossier City system).
- Advanced Freeway and Incident Management Systems including network surveillance.
- Advanced Traveler Information Dissemination Systems.
- Roadway Weather Information Systems.
- Emergency Management Systems.
- Advanced Public Transportation Systems.

To implement these strategies the ITS field deployment for the Shreveport/Bossier City region will consist of 579 radar vehicle detectors (RVDs), 220 closed-circuit television (CCTV) cameras, 15 dynamic message signs (DMSs), signal system improvements at 395 intersections, 10 weather stations, and 4 highway advisory radio (HAR) stations. The general methodology for determining the number of proposed field devices is as follows:

- RVDs. Eight per “controlled-access” centerline mile (i.e. one every 0.25 miles per direction). An additional four RVDs are assumed for required coverage of major interchanges. For the purposes of determining the overall proposed deployment, the following thirteen locations are designated as “major interchanges”: I-20 / I-220 / LA 3132; I-20 / I-49; I-20 / LA 1; I-20 / LA 3105; I-20 / LA 526; I-20 / I-220 (East); LA 3132 / Linwood Avenue; LA 3132 / LA 523; LA 3132 / LA 526; I-220 / US 71 / LA 1; I-220 / LA 3105; I-49 / LA 526; and I-49 / LA 3132.
- CCTV Cameras. Two per “controlled-access” centerline mile (i.e. one every 0.5 miles). Additional coverage is assumed at major interchanges (two additional cameras per each) and one each at selected (60) critical signalized intersections (see **Table 3.2**). The total does not include weather station CCTV cameras.
- DMSs. On “controlled-access” facilities as-needed, but typically one per direction between major interchanges, placed a minimum of approximately 0.5 miles upstream of potential diversion routes. The total does not include three DMSs planned by others (Reduced Visibility Enhancement Phase 2 [State Project No. 737-99-0467]).
- Signals. Traffic signal system improvements at existing surface street signalized intersections.

- Weather Stations. One per area/facility with a high potential for icing as indicated by the stakeholders. Each station includes one CCTV camera.
- HAR Stations. With a 3 to 5 mile radius (6 to 10 mile diameter) coverage per station, a total of four stations should provide adequate coverage for the region without undue interference between stations.

Communications to and from these field devices is proposed via a fiber optic trunk line and hybrid fiber/wireless distribution system. Management of the Immediate-term and a portion of the Near-term deployment is envisioned from Interim TMCs at the existing DOTD District 04 office and the existing City of Shreveport Traffic Engineering office. A new RTMC and Maintenance Facility will ultimately be constructed to consolidate resources and facilitate effective systems maintenance and operations.

Table 3.1 Proposed Primary ITS Deployment (Unconstrained)

Deployment		Facility/Component			Proposed				
Timeframe	Phase	Name	Location	Type	RVD	CCTV	DMS	Signals	Weather
All	All	Primary (trunkline) communications	I-220 to LA 3105 to US 71 to LA 511 to LA 3132	Fiber optic					
		Secondary (distribution) communications	Field devices to trunkline	Hybrid fiber/wireless					
Immediate	1	LA 511	LA 3132 (East) to west of Gilbert Drive	Surface street		1		7	
		LA 3132	South of LA 511 (East) to LA 526	Surface street		6		7	
		LA 1	LA 523 to Gator Street	Surface street		3		9	
		McDade Street	US 71 to Arthur Teague Parkway	Surface street		1		2	
		LA 3	Riverwood Drive to Shed Road	Surface street				2	
	2	LA 526	West of LA 3132 to Flournoy and Lucas Road	Surface street		5		10	
		US 171	Williamson Way to LA 3132	Surface street		7		12	
		Jewella Road	West of US 171 to Meriwether Road	Surface street				4	
	3	LA 1	North of Gator Street to Lake Street	Surface street		2		11	
		LA 511	West of Gilbert Drive to West Canal Boulevard	Surface street		3		9	
		US 171	North of LA 3132 to south of LA 511	Surface street				2	
Near	1	I-20	I-220/LA 3132 to I-220 (East)	Controlled-access	117	30	5		
		I-20/I-220/LA 3132 interchange	-	Major interchange	4	2			
		I-20/I-49 interchange	-	Major interchange	4	2			
		I-20/LA 1 interchange	-	Major interchange	4	2			
		I-20/LA 3105 interchange	-	Major interchange	4	2			
		I-20/I-220 (East) interchange	-	Major interchange	4	2			
		Highway Advisory Radio stations	Four stations (sites to be determined)	10 watt					
		DOTD Interim TMC	Within existing DOTD District 04 office	Interim					
		Software & Integration	DOTD Interim TMC	Network management					
		Shreveport Interim TMC	Within exiting Shreveport Traffic Engineering office	Interim					
		Software & Integration	Shreveport Interim TMC	Network management					
	2	LA 3132/Linwood Avenue interchange	-	Major interchange	4	2			
		LA 3132/LA 523 interchange	-	Major interchange	4	2			
		LA 3132/LA 526 interchange	-	Major interchange	4	2			
		I-220	I-20/LA 3132 to I-20 (East)	Controlled-access	143	36	5		
		I-220/US 71/LA 1 interchange	-	Major interchange	4	2			
		I-220/LA 3105 interchange	-	Major interchange	4	2			
		I-49/LA 526 interchange	-	Major interchange	4	2			
		I-49/LA 3132 interchange	-	Major interchange	4	2			
	3	RTMC	Site of existing DOTD District 04 office	Regional					
		Regional Maintenance Facility	Site of existing DOTD District 04 office	Regional					
		Software & Integration	RTMC	Traffic management					
	4	US 71/LA 1	LA 3194 to north of Lake Street	Surface street		8		21	
	5	Kings Highway	LA 3094 to west of LA 1	Surface street		4		17	
		LA 3032	East of LA 1 to US 71	Surface street		1		7	
		LA 511	US 71 to east of LA 3132 (East)	Surface street		2		3	
		US 79/80	LA 3105 to Murphy Street	Surface street		2		14	
		Murphy Street	West of US 79/80 to Allen Avenue	Surface street				3	
		LA 3	North of Riverwood Drive to Kingston Road	Surface street				4	
		LA 3	South of Shed Road to I-20	Surface street		1		5	
		US 71	I-20 to north of LA 511	Surface street				9	

Table 3.1 Proposed Primary ITS Deployment (Unconstrained)

Deployment		Facility/Component			Proposed					
Timeframe	Phase	Name	Location	Type	RVD	CCTV	DMS	Signals	Weather	
Near	5	LA 3105	North of US 71 to Kingston Road	Surface street		3		11		
		Shed Road	LA 3105 to east of LA 3	Surface street				1		
		Swan Lake Road	US 79/80 to Flat River Drainage Canal	Surface street		1		2		
	6	LA 3094	South of US 71/LA 1 to I-20	Surface street		2		10		
		US 171	South of I-20 to north of LA 511	Surface street				7		
	7	I-49	I-20 to 0.5 mile south of LA 526 interchange	Controlled-access	61	16	3			
Mid/Long	1	LA 3132	I-20/I-220 to LA 526	Controlled-access	75	19	2			
		I-20/LA 526 interchange	-	Major interchange	4	2				
		I-20	I-220/LA 3132 to LA 526	Controlled-access	27	7				
	2	LA 511	LA 526 to west of West Canal Boulevard	Surface street		2		6		
		Pines Road	I-20 to north of LA 511	Surface street		3		3		
		Jewella Road	Lakeshore Drive to north of Meriwether Road	Surface street		3		12		
		Line Avenue	I-20 to Flournoy and Lucas Road	Surface street				17		
	3	LA 526	US 79/80 to west of Flournoy and Lucas Road	Surface street				4		
		LA 173	Parish Route 9 (Roy Road) to I-220	Surface street				1		
		Allen Avenue	Milam Street to I-20	Surface street				1		
		Linwood Avenue	I-20 to LA 523	Surface street				12		
	4	US 79/80	South of Murphy Street to Pines Road	Surface street				15		
		Hollywood Avenue	Monkhouse Drive to I-49	Surface street				8		
		Pierremont Road	East of I-49 to west of LA 1	Surface street				5		
		Southfield Road	East of LA 1 to East Kings Highway	Surface street				2		
	5	Shreveport signals	Central business district	Surface street				27		
	6	Murphy Street/Stoner Avenue	East of LA 3094 to east of LA 1	Surface street				7		
		Lakeshore Drive/Yarbrough Road	I-20 to Pines Road	Surface street				6		
		Pines Road	South of Yarbrough Road to Jefferson-Paige Road	Surface street				1		
	7	Shreveport signals	All remaining	Surface street				79		
	8	Weather stations	Various	Includes CCTV camera					10	
		I-20	LA 526 to 0.5 mile west of LA 169 interchange	Controlled-access	44	11				
		I-20	I-220 (East) to 0.5 mile east of LA 157 interchange	Controlled-access	60	15				
	TOTAL					579	220	15	395	10

Note: Transit deployment not included (see *Table 3.5*).

Table 3.2 Signalized Intersections Targeted for CCTV Camera Deployment

Timeframe	Phase	Location
Immediate	1	Industrial @ Youree
		Industrial @ Inner Loop
		Industrial @ Millicent
		Industrial @ Fern
		Industrial @ Wal-Mart
		Industrial @ East Kings
		Youree @ 70th
		Youree @ Gator
		Youree @ University
		Youree @ Target
		US 71 (Barksdale Boulevard) @ LA 3032 (Westgate Drive)
	2	Industrial @ Mansfield
		Industrial @ I-49
		Industrial @ Linwood
		Industrial @ Kingston
		Industrial @ Walker
		Mansfield @ Jewella
		Mansfield @ Alkay
		Mansfield @ Lola
		Mansfield @ Innerloop*
		Mansfield @ Hoyte
		Mansfield @ Southland Park
	3	Youree @ E. Kings
		Youree @ Southfield
		70th @ Mansfield
		70th @ Line
		70th @ St. Vincent
Near	4	North Market @ I-220
		North Market @ Martin Luther King/Ravendale
		North Market @ Hearne
		North Market @ Nelson
		North Market @ Common Extension
		Market @ Texas
		Spring @ Texas
		Spring @ Caddo
	5	Kings @ Linwood
		Kings @ Line
		Kings @ Fairfield
		Kings @ Hearne
		US 80 (East Texas Street) @ LA 3 (Benton Road)
		US 80 (East Texas Street) @ Swan Lake Road
		US 80 (East Texas Street) @ LA 3105 (Airline Drive)
		LA 3105 (Airline Drive) @ I-20*
		LA 3105 (Airline Drive) @ LA 72 (Old Minden Road)
		US 71 (Barksdale Boulevard) @ LA 511 (Jimmie Davis Highway)
		US 71 (Barksdale Boulevard) @ LA 3032 (Westgate Drive)
		LA 3 (Benton Road Spur) / LA 72 (Old Minden Road) @ I-20
		LA 511 (Jimmie Davis Highway) @ CenturyTel Center Drive / Zach Avenue
	6	Hearne @ I-20
		Hearne @ I-20 / Claiborne
Mid/Long	2	Pines @ I-20*
		Pines @ Financial / Westport
		Jewella @ I-20*
		Jewella @ Hollywood
		70th @ Innerloop*

* Two signalized intersections at this location. Therefore, two cameras are assumed.

Table 3.3 Cost Basis

Item		Unit Cost			
Name	Unit	Construction ⁽¹⁾	Comments	Annual ⁽²⁾	Comments
Radar Vehicle Detector (RVD)	each	\$20,000	Includes communications equipment at device	\$400	2% of construction
Closed Circuit Television (CCTV) Camera	each	\$23,000	Includes communications equipment at device	\$1,150	5% of construction
Dynamic Message Sign (DMS)	each	\$150,000	Includes communications equipment at device	\$7,500	5% of construction
Signal System Improvements (Signals)	each	\$100,000	Includes communications equipment at device	\$5,000	5% of construction
Weather Station (Weather)	each	\$35,000	Includes communications equipment at device	\$1,750	5% of construction
Highway Advisory Radio Station	each	\$65,000	Includes communications equipment at device	\$1,300	2% of construction
Interim TMC	each	\$300,000	Includes two workstations and web server	\$15,000	5% of construction
RTMC	each	\$3,000,000	20K sf at \$150 per sf; includes webpage	\$110,000	20K sf at \$5.50 per sf; does not include staffing
Regional Maintenance Facility	each	\$1,560,000	24K sf at \$65 per sf	\$54,000	24K sf at \$2.25 per sf; does not include staffing
primary (trunkline) communications	lump	\$3,420,000	34.2 miles at \$100K per mile; assumes new agency-owned buried single-mode fiber installation. Includes optical fiber cable, buried conduit, one handhole/junction box every 300 feet (typ.)	\$256,500	7.5% of construction
secondary (distribution) communications	lump	\$3,450,000	115 miles at \$30K per mile; assumes new agency-owned wireless Ethernet and aerial fiber	\$172,500	5% of construction
Software & Integration (Interim TMC)	each	\$100,000	None	\$5,000	5% of construction
Software & Integration (RTMC)	each	\$2,000,000	None	\$100,000	5% of construction

(1) Purchase and installation cost. Contingency not included. Year 2002 dollars.

(2) Maintenance and operations cost. Contingency not included. Year 2002 dollars.

Note: Transit deployment not included (see *Table 3.5*).

Table 3.4 Summary of Proposed ITS Deployment (Unconstrained)

Timeframe	Phase	Description	Construction Cost ⁽¹⁾	Design Cost ⁽²⁾
All	All	primary (trunkline) communications	\$8,244,000	\$824,400
		secondary (distribution) communications		
		SUBTOTAL	\$8,244,000	\$824,400
Immediate	1	11 CCTV cameras signal system improvements at 27 intersections	\$951,600	\$95,160
	2	12 CCTV cameras signal system improvements at 26 intersections	\$3,451,200	\$345,120
	3	5 CCTV cameras signal system improvements at 22 intersections	\$2,778,000	\$277,800
		SUBTOTAL	\$7,180,800	\$718,080
Near	1	DOTD Interim TMC Shreveport Interim TMC DOTD Interim TMC Software & Integration Shreveport Interim TMC Software & Integration 137 radar vehicle detectors 40 CCTV cameras 5 dynamic message signs 4 highway advisory radio stations	\$6,564,000	\$656,400
	2	171 radar vehicle detectors 50 CCTV cameras 5 dynamic message signs	\$6,384,000	\$638,400
	3	RTMC & Maintenance Facility RTMC Software & Integration	\$7,872,000	\$787,200
	4	8 CCTV cameras signal system improvements at 21 intersections	\$2,740,800	\$274,080
	5	14 CCTV cameras signal system improvements at 76 intersections	\$9,506,400	\$950,640
	6	2 CCTV cameras signal system improvements at 17 intersections	\$2,095,200	\$209,520
	7	61 radar vehicle detectors 16 CCTV cameras 3dynamic message signs	\$2,445,600	\$244,560
		SUBTOTAL	\$37,608,000	\$3,760,800
Mid/Long	1	106 radar vehicle detectors 28 CCTV cameras 2 dynamic message signs	\$3,676,800	\$367,680
	2	8 CCTV cameras signal system improvements at 38 intersections	\$4,780,800	\$478,080
	3	signal system improvements at 18 intersections	\$2,160,000	\$216,000
	4	signal system improvements at 30 intersections	\$3,600,000	\$360,000
	5	signal system improvements at 27 intersections	\$3,240,000	\$324,000
	6	signal system improvements at 14 intersections	\$1,680,000	\$168,000
	7	signal system improvements at 79 intersections	\$9,480,000	\$948,000
	8	104 radar vehicle detectors 26 CCTV cameras 10 weather stations (includes one CCTV camera per station)	\$3,633,600	\$363,360
		SUBTOTAL	\$32,251,200	\$3,225,120
		TOTAL	\$85,284,000	\$8,528,400

(1) Purchase and installation. Includes 20% contingency. Year 2002 dollars.

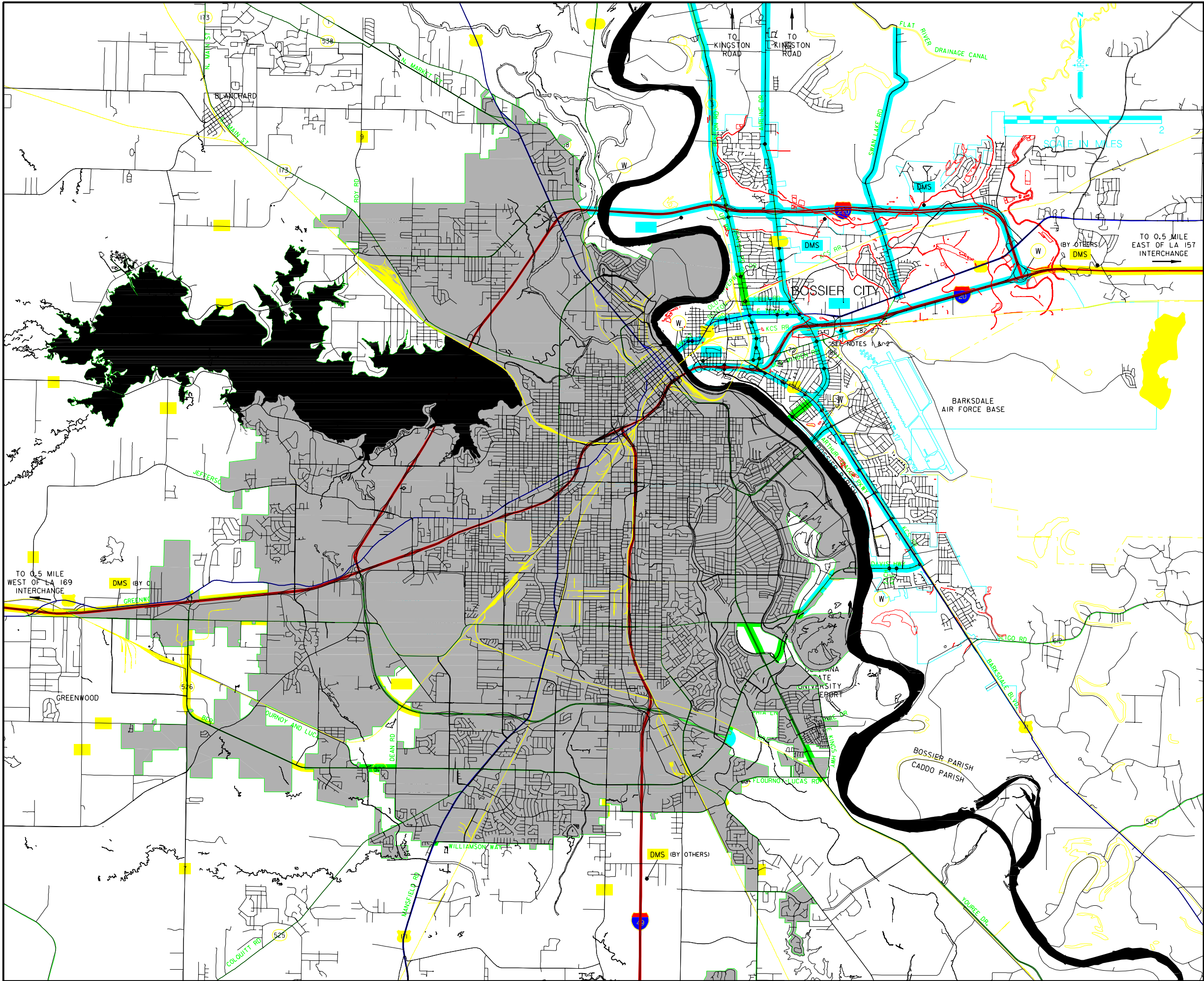
(2) 10% of "Construction" cost. Year 2002 dollars.

Note: Transit deployment not included (see *Table 3.5*).

Table 3.5 Summary of Proposed Transit ITS Deployment (Unconstrained)

Phase & Investment		Estimated Implementation Cost ⁽¹⁾	Comments
Near-Term			
N-1:	Preliminary Design & Communications System Study	\$50,000	Study to detail overall ITS transit needs and analyze communications issues.
N-2:	Radio System Upgrade (partial)	\$400,000	Preliminary estimate for dispatch center equipment only; communications system study required to further identify cost.
N-3:	CAD/AVL System with APCs and Enunciators	\$1,750,000	AVL for all vehicles, including additional radio system upgrade, supervisory and maintenance. APCs for approximately 4 fixed-route vehicles; enunciators for all fixed-route vehicles.
Near-Term Subtotal		\$2,200,000	
Mid-Term			
M-1:	Demand-Responsive Passenger Information/Fare System	\$250,000	Cost includes specification development.
M-2:	Initial Real-Time Bus Status Information System and Transfer Coordination	\$200,000	Can be bundled with N-3, which will provide the design and integration. This cost is for hardware (signs) and installation.
M-3:	Automated Trip Planning System	\$300,000	Includes cost for software.
M-4:	Expanded Real-Time Bus Status Information System	\$200,000	Additional signs/monitors.
M-5:	Enhanced Demand-Responsive Service Coordination	\$250,000	Utilize systems implemented in N-3. This cost supports any required communications or software additions.
Mid-Term Subtotal		\$1,200,000	
Long-Term			
L-1:	On-Board and Station Security Recording	\$300,000	Selected routes/vehicles and key stops/centers.
L-2:	Enhanced Vehicle Monitoring	\$350,000	Cost dependent on specific approach.
L-3:	Real-Time On-Board Security Monitoring	\$500,000	None.
Long-Term Subtotal		\$1,150,000	None.
Program Total		\$4,550,000	

(1) Contingency not included. Year 2002 dollars.



- LEGEND
- INTERSTATE ROUTE
 - UNITED STATES ROUTE
 - STATE ROUTE
 - PARISH ROUTE
 - IMMEDIATE-TERM PRIORITY
 - NEAR-TERM PRIORITY
 - MID TO LONG-TERM PRIORITY (SEE NOTE 3)
 - SIGNALIZED INTERSECTION
 - DMS
 - WEATHER STATION (INCLUDES ONE CCTV CAMERA)

- NOTES:
- INTERIM TMC COMPONENTS TO BE LOCATED AT EXISTING DOTD DISTRICT 04 OFFICE (3339 INDUSTRIAL DR., BOSSIER CITY) AND EXISTING CITY OF SHREVEPORT TRAFFIC ENGINEERING OFFICE (2123 LAKESHORE DR., SHREVEPORT).
 - REGIONAL TMC & MAINTENANCE FACILITY TO BE LOCATED AT SITE OF EXISTING DOTD DISTRICT 04 OFFICE.
 - MID TO LONG-TERM PRIORITY INCLUDES ALL REMAINING TRAFFIC SIGNALS IN SHREVEPORT (APPROX. 79).
 - A TOTAL OF THREE DYNAMIC MESSAGE SIGNS ARE PLANNED BY OTHERS (REDUCED VISIBILITY ENHANCEMENT PHASE 2 S.P. No. 737-99-0467) AS NOTED.



Shreveport/Bossier City Regional ITS
Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253

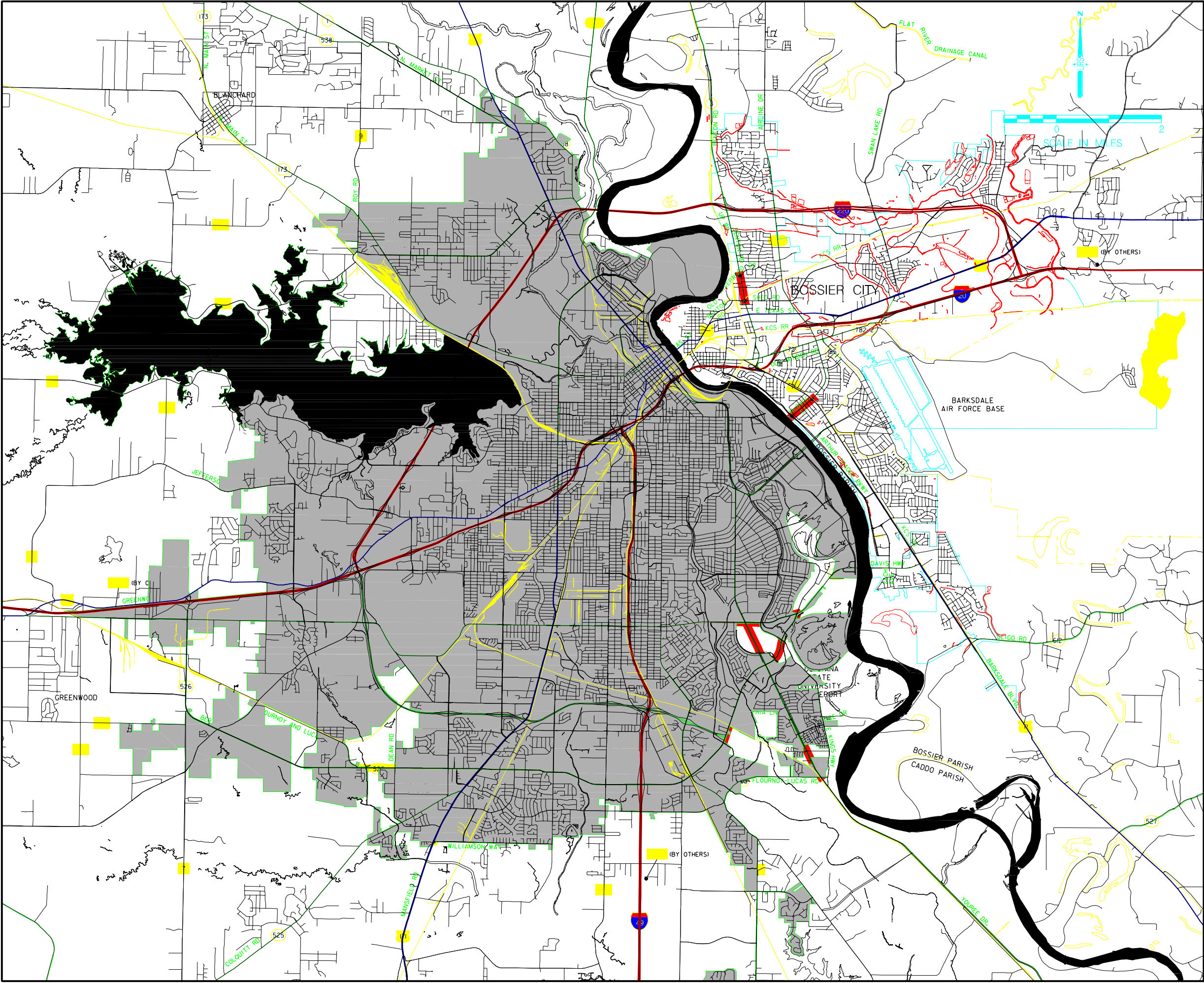


Figure 3.1
Proposed Primary ITS Deployment
(Unconstrained)

URS

PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.

URS Project No. 04-00046316.02 | DATE: MAY 2002



- LEGEND
- INTERSTATE ROUTE
 - UNITED STATES ROUTE
 - STATE ROUTE
 - PARISH ROUTE
 - PHASE 1
 - PHASE 2
 - PHASE 3
 - SIGNALIZED INTERSECTION
 - DYNAMIC MESSAGE SIGN

NOTE:

1. A TOTAL OF THREE DYNAMIC MESSAGE SIGNS ARE PLANNED BY OTHERS (REDUCED VISIBILITY ENHANCEMENT PHASE 2 S.P. No. 737-99-0467) AS NOTED.



Shreveport/Bossier City Regional ITS
Strategic Deployment Plan
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State Project No. 700-99-0253

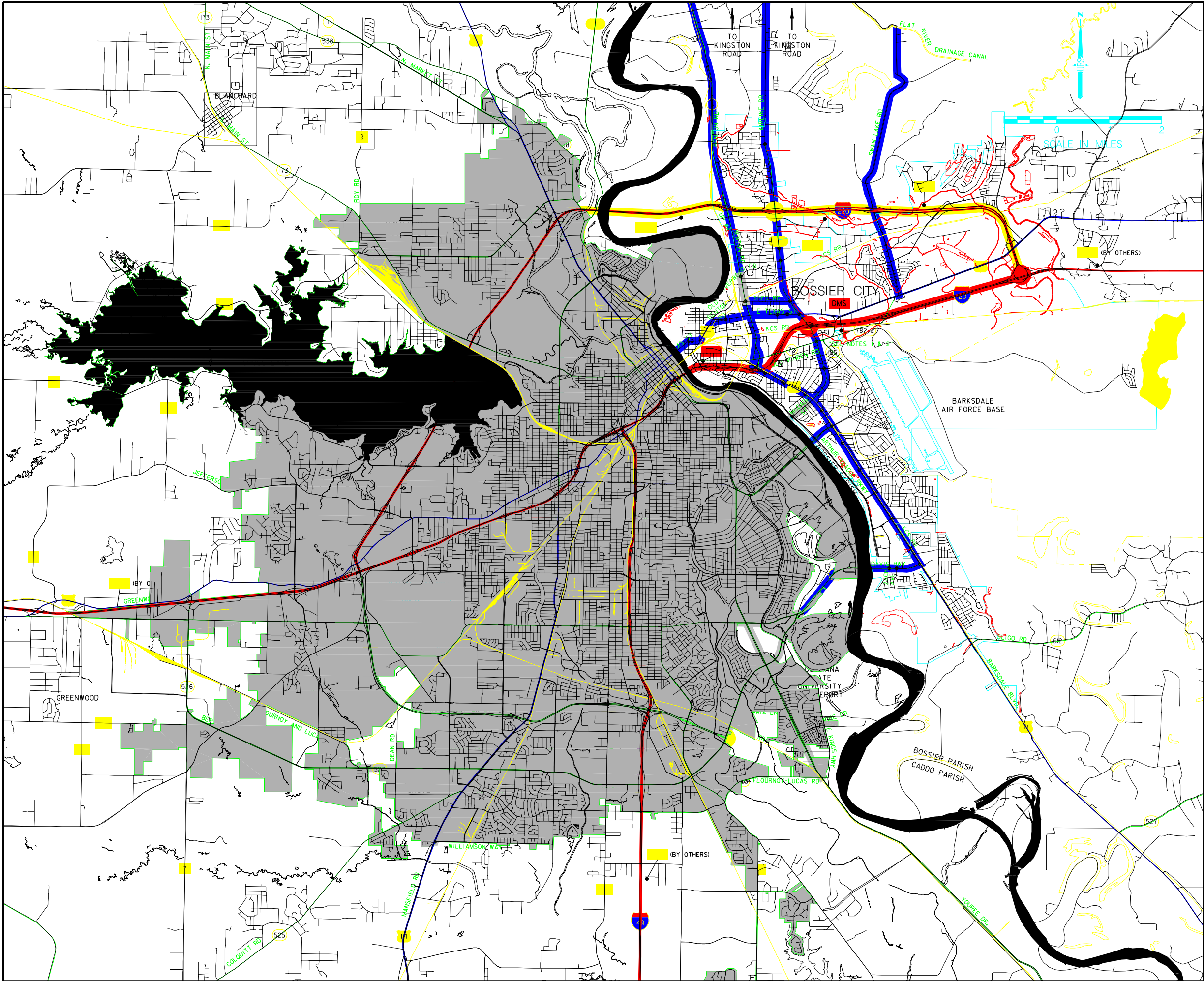


Figure 3.2
Immediate-Term ITS Deployment
(Unconstrained)

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URS Project No. 04-00046316.02 | DATE: MAY 2002



LEGEND



INTERSTATE ROUTE



UNITED STATES ROUTE



STATE ROUTE



PARISH ROUTE



PHASE 1



PHASE 2



PHASE 3



PHASE 4



PHASE 5



PHASE 6



PHASE 7



IMMEDIATE-TERM PRIORITY



SIGNALIZED INTERSECTION



DYNAMIC MESSAGE SIGN

NOTES:

1. INTERIM TMC COMPONENTS TO BE LOCATED AT EXISTING DOTD DISTRICT 04 OFFICE (3339 INDUSTRIAL DR., BOSSIER CITY) AND EXISTING CITY OF SHREVEPORT TRAFFIC ENGINEERING OFFICE (2123 LAKESHORE DR., SHREVEPORT). (PHASE 1)
2. REGIONAL TMC & MAINTENANCE FACILITY TO BE LOCATED AT SITE OF EXISTING DOTD DISTRICT 04 OFFICE. (PHASE 3)
3. A TOTAL OF THREE DYNAMIC MESSAGE SIGNS ARE PLANNED BY OTHERS (REDUCED VISIBILITY ENHANCEMENT PHASE 2 S.P. No. 737-99-0467) AS NOTED.



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State Project No. 700-99-0253

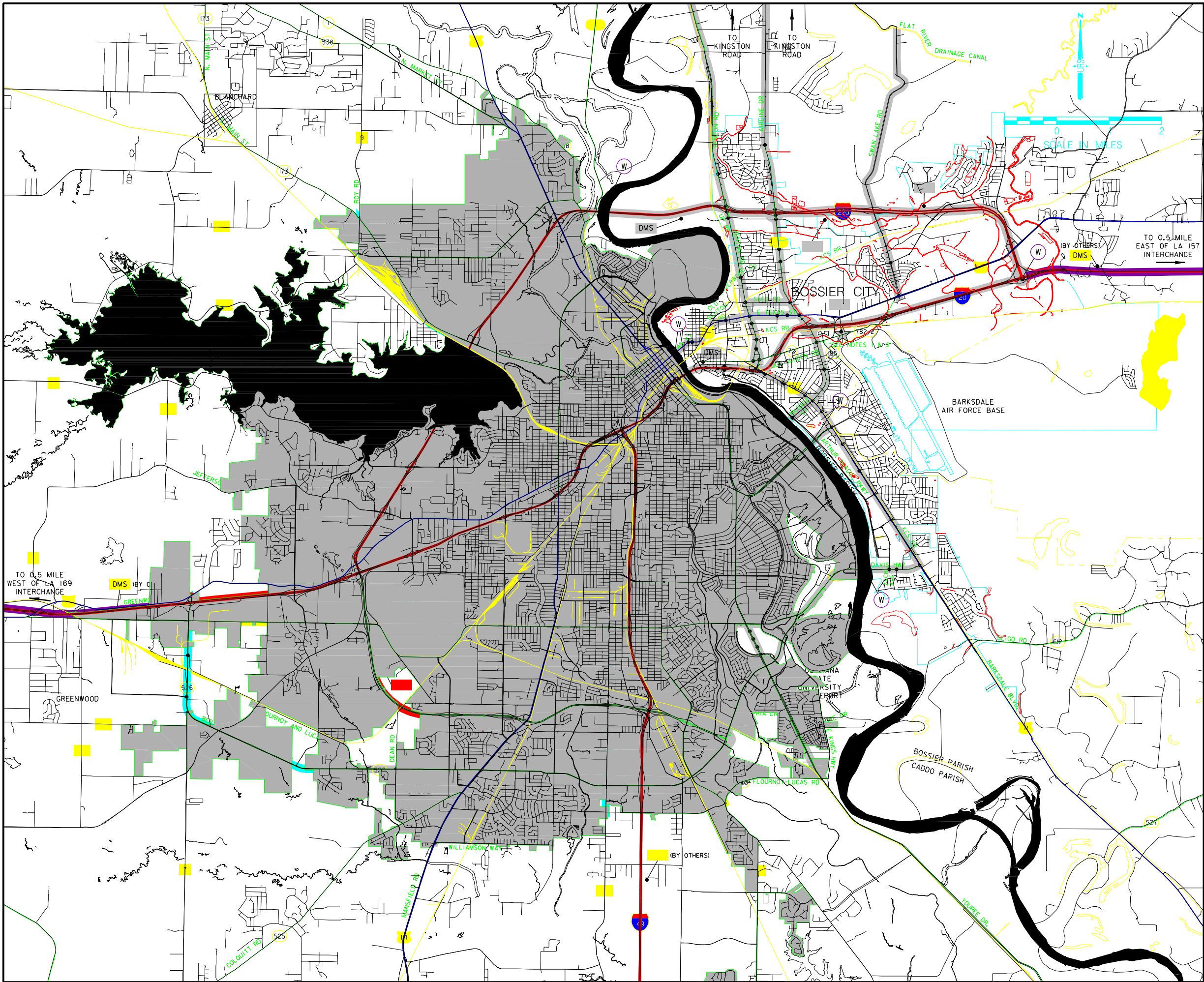


Figure 3.3
Near-Term ITS Deployment
(Unconstrained)

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LEGEND

	INTERSTATE ROUTE
	UNITED STATES ROUTE
	STATE ROUTE
	PARISH ROUTE
	PHASE 1
	PHASE 2
	PHASE 3
	PHASE 4
	PHASE 5
	PHASE 6
SEE NOTE 3	PHASE 7
	PHASE 8
	IMMEDIATE & NEAR-TERM PRIORITY
	SIGNALIZED INTERSECTION
	DYNAMIC MESSAGE SIGN
	WEATHER STATION (INCLUDES ONE CCTV CAMERA)

NOTES:

- INTERIM TMC COMPONENTS TO BE LOCATED AT EXISTING DOTD DISTRICT 04 OFFICE (3339 INDUSTRIAL DR., BOSSIER CITY) AND EXISTING CITY OF SHREVEPORT TRAFFIC ENGINEERING OFFICE (2123 LAKESHORE DR., SHREVEPORT).
- REGIONAL TMC & MAINTENANCE FACILITY TO BE LOCATED AT SITE OF EXISTING DOTD DISTRICT 04 OFFICE.
- PHASE 7 IS ALL REMAINING TRAFFIC SIGNALS IN SHREVEPORT (APPROX. 79).
- A TOTAL OF THREE DYNAMIC MESSAGE SIGNS ARE PLANNED BY OTHERS (REDUCED VISIBILITY ENHANCEMENT PHASE 2 S.P. No. 737-99-0467) AS NOTED.

Shreveport/Bossier City Regional ITS Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253

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Figure 3.4
Mid To Long-Term ITS Deployment (Unconstrained)

URS Project No. 04-00046316.02 | DATE: MAY 2002

3.2 Component/System Descriptions and Typical Costs

This section focuses primarily on the field devices/systems of the proposed deployment. Note that the costs of installing these ITS components can vary greatly depending on several factors, including system operational objectives and technology choices.

3.2.1 Communications Network

The communications network is an integral part of the overall traffic management system design, in that it will affect and be affected by system architecture, configuration, and operational strategies. Moreover, if thought of as a single expense, the communications network will likely be the costliest component. It will also contain some of the most complex and advanced technology deployed in the system.

Cabling

Communications cabling provides connections between the field cabinets and the TMC. It is recommended that single mode fiber optic cable be used for communications network cabling. Trunk fibers carry communications between the TMC and the field cabinets located along the core network. Distribution fibers will carry communications between the core network and the edge (field device) network.

Conduit

The conduit system deployed should provide room for growth and provide protection to the fiber optic cable. Additional conduit can be placed in areas that have a high potential for agencies to lease or sell.

The conduit system provides a path for the communications cabling. The cost of installing conduit systems is a significant portion of the cost of installing field elements. Conduit systems include trenching, conduit, junction boxes, manholes, and under-bridge conduit supports.

Typical conduits include:

- 50 – 100mm (2" - 4") PVC conduit
- 50 – 100mm (2" - 4") rigid metal conduit
- 100mm (4") multi-duct conduit (both PVC and metal)

Multi-duct conduit provides a large outer conduit, which contains three or four smaller conduit inner-ducts; a common size of multi-duct is 100mm (4"). This multi-duct has a 100mm outer conduit with four 33mm (1-1/4") inner-ducts. While multi-duct costs more to install initially than a single conduit, maintenance and growth installation using the same conduit becomes much easier. Multiple cables pulled in a single conduit twist together during installation, making removal of a single cable or pulling of a new cable quite difficult. Often all existing cables in the conduit must be removed. By using multi-duct, cables may be pulled in the open inner-ducts

without affecting cables in the other inner-ducts. Therefore, to compare functionality, the cost of a multi-duct conduit should be compared to the cost of multiple regular conduits. This comparison shows multi-duct conduit to be less expensive than regular conduit. Short runs of conduit are generally easier with regular conduit. Also, power cabling does not really benefit from the use of multi-duct conduit. Therefore, both regular and multi-duct conduits are typically used.

Field Cabinets

Field cabinets are roadside enclosures that house and protect the equipment and cabling connections. The number of field cabinets that are required to house the various equipment controllers could vary considerably, depending upon operational objectives and local considerations.

The opportunity to co-locate different types of equipment in the same field cabinet requires that each piece of equipment be able to perform its desired function from that controller cabinet site. For example, if the CCTV cameras are to provide verification of DMS displays, the chances of co-locating the DMS controller and CCTV controller are quite low. (If the camera is too close to the sign, then it is often difficult to view the DMS and the sign can create a large blind spot for the camera.)

The typical cost below includes the cabinet enclosure, foundation, and power equipment (the power equipment required for a cabinet typically includes a transformer, disconnect switch, breakers or fuses, and terminal blocks). The cabinet cost does not include communications equipment and controllers.

Cabinet Item	Typical Unit Cost (per each)
Single Communications Cabinet	\$5,500

The typical communications component and network costs (summarized in the “Communications Network” table below) is based on the following assumptions:

- The Fiber Optic cable shall be single mode cable.
- Multi-Duct PVC conduit will be used for the communications duct system.
- Metal conduit will be hung under the bridges.
- 50mm (2") conduits will be used for communications cabling (these conduits will provide for spur connections and runs from the main communications conduits to each individual cabinet).
- Handholes will be spaced 300 feet apart with separate boxes for power and communications.

- Additional handhole boxes will be provided at cabinet and load center locations.
- Component unit costs as follows:

Item Description	Typical Unit Cost (per meter)		Total
	Material	Labor	
Trenching	\$7.00	\$5.00	\$12.00
4" PVC Multi-duct	\$22.50	\$7.50	\$30.00
2" PVC	\$4.50	\$2.50	\$7.00
2" Rigid	\$6.75	\$2.75	\$9.50
Handholes	\$350.00	\$100.00	\$450.00
Manholes	\$1,700.00	\$600.00	\$2,300.00
Junction box	\$125.00	\$75.00	\$200.00
Communications Cabinets (Single Style)	\$4,000.00	\$1,500.00	\$5,500.00
Fiber Optic Cable (Trunk Cable)	\$4.00	\$3.75	\$7.75
Fiber Optic Cable (Distribution Cable)	\$7.00	\$3.75	\$10.75

The following table indicates the typical cost range for a hybrid fiber/wireless communications network. A number of factors will ultimately determine the overall cost of the communications system.

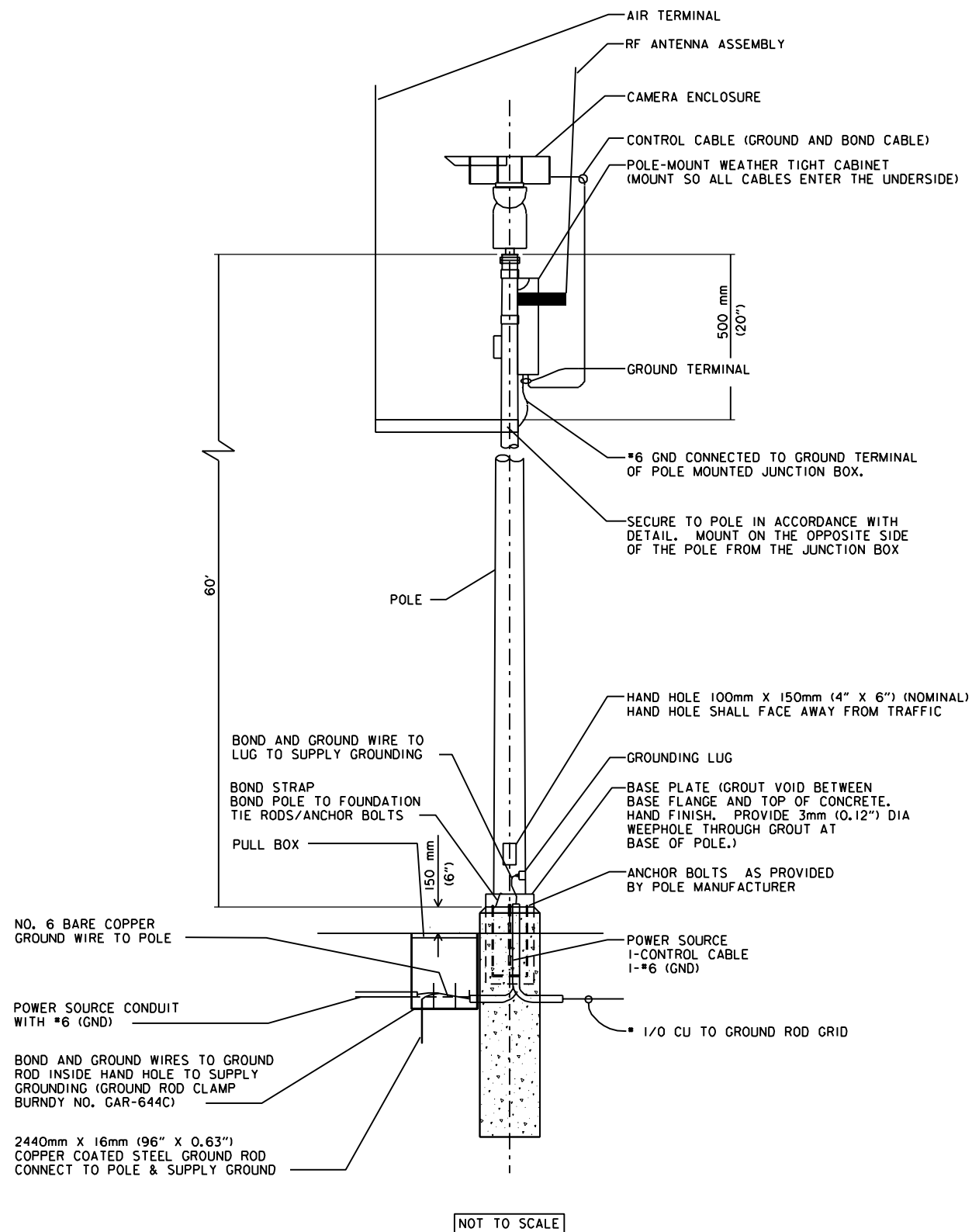
Communications Network	Typical Unit Cost (per mile)
Hybrid Network (combination of technologies)	\$30,000 to \$50,000

Brief descriptions and typical unit costs for each of the field devices comprising the proposed overall systems deployment is presented in the following Sections. Typical or average component configurations are assumed. Actual costs for the Shreveport/Bossier City deployment will be determined during subsequent project design phases.

3.2.2 Closed Circuit Television (CCTV) Cameras

Closed circuit television (CCTV) cameras (see *Figure 3.5*) provide video feeds of traffic conditions. These video images allow real-time evaluation and monitoring of all traffic conditions, including incidents. The area of freeway covered by the system should have “full visual coverage” of the freeway. Full coverage means that:

- All portions of the travel lanes and shoulders of the interstate mainline;
- All portions of the travel lanes and shoulders of interstate/interstate interchange ramps; and



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Figure 3.5
CCTV CAMERA
POLE-MOUNT DETAIL

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- Nearly all portions of travel lanes and shoulders of interstate/arterial interchange ramps are visible from at least one of the system's cameras. In general, locating cameras to maximize the viewing area for each camera minimizes the number of cameras required to provide coverage of a roadway. The following will control the number and locations of cameras:
 - Horizontal and vertical roadway alignment;
 - View obstructions (trees, overhead signs, etc.);
 - Camera mounting height;
 - Camera and lens selection (camera viewing distance);
 - Roadway access control gate verification;
 - Crossroad surveillance requirements; and
 - Other local requirements.

Locating cameras at the crest of vertical curves and on the outside of horizontal curves maximizes the viewing area for each camera. Also, locating cameras to minimize view obstructions maximizes the viewing area for each camera. Along a relatively straight stretch of road with minimal view obstructions, a camera mounting height of 15 meters (50 feet), spacing of 800m (½ mile), and a 10X lens is a commonly used configuration that provides full coverage. Multiple cameras are typically required to provide full coverage in an interchange.

Roadway lighting levels will affect the choice of camera technology. Color cameras typically require that the roadway lighting provide a minimum of 2.3 lux/square meter (0.2 foot-candles/square foot) and an average of 7 to 9 lux/square meter (0.6-0.8 foot-candles/square foot). Black and white cameras work well in lower light levels (better than color cameras).

Advantage

Available CCTV systems that satisfy all the above purposes are now reliable and affordable.

Disadvantage

Maintenance and operating costs. Recorded images of incidents can sometimes have negative legal consequences for an agency.

Typical CCTV Location Costs

Costs directly associated with a typical camera installation on new structures are shown in the following table.

Typical Camera Location	Typical Unit Cost (per each)
Camera Pole	\$8,000
Camera pole foundation	\$7,000
Camera/lens/enclosure assembly	\$8,000
TOTAL COST	\$23,000

Option: Camera Raise/Lower System

This system enables maintenance personnel to rise and lower overhead cameras to ground level and perform any maintenance required rather than using a bucket truck with a 50' reach. The following table indicates associated costs.

Retro Camera Raise/Lower System	Typical Unit Cost (per each)
Camera Raise/Lower System	\$8,000

3.2.3 Radar Vehicle Detectors

Radar vehicle detectors (RVDs) (see **Figure 3.6**) provide traffic volume, occupancy, and speed. Current RVD technology has not demonstrated the ability to classify traffic into the FHWA vehicle categories. This traffic flow information can be used for incident detection and planning purposes. Typically detectors are setup at ¼ mile or ½ mile spacing in urban areas.

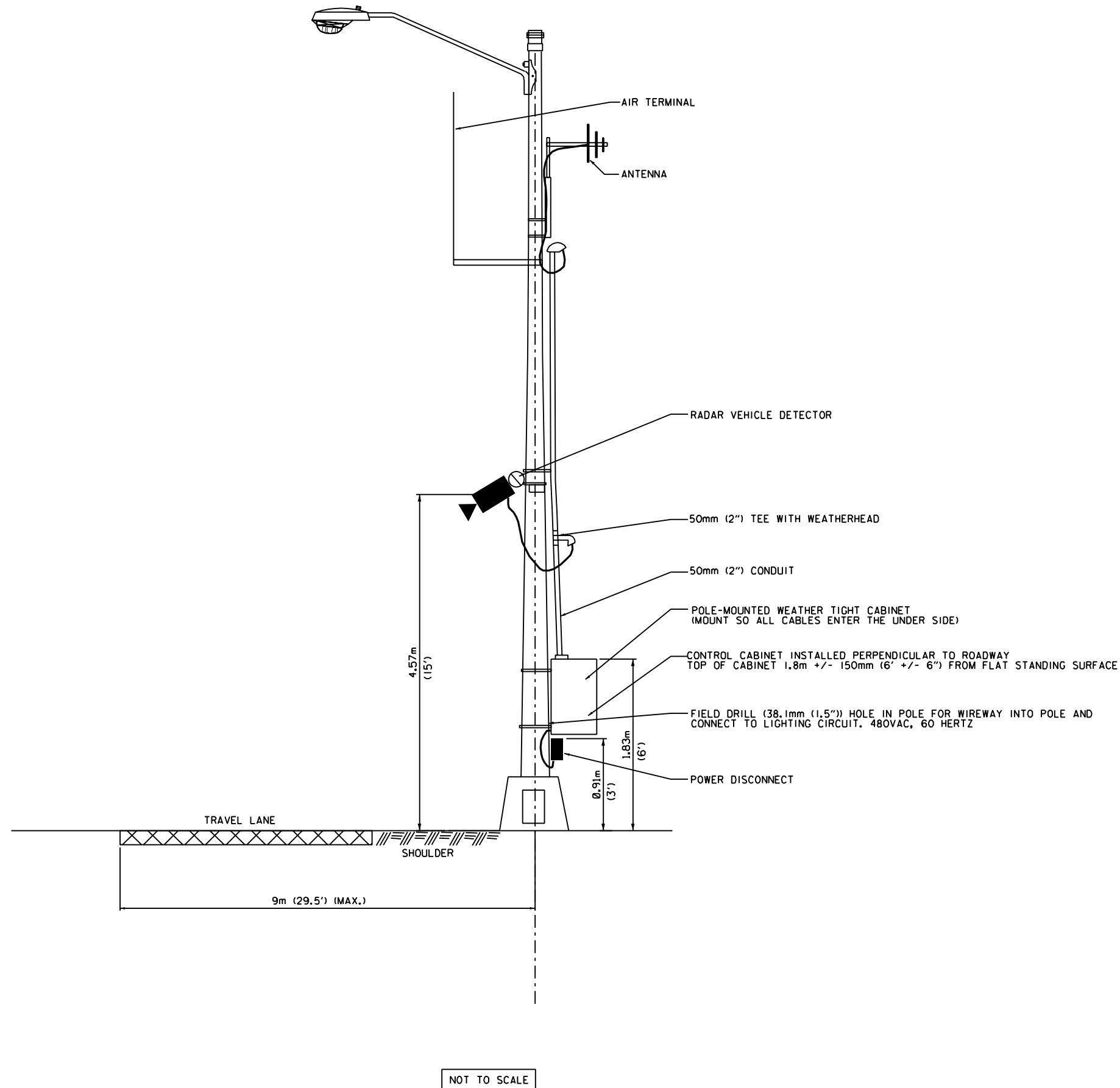
RVDs may be setup in either side-fire mode or over-the-lane mode. In over-the-lane mode one detector is mounted over each lane to be monitored. In side-fire mode, detectors are mounted on a pole at the edge of the shoulder. Some products can cover multiple lanes with a single detector unit when setup in side-fire mode, thereby reducing the number of detectors required together the desired data. Side-fire mode configurations have lower accuracy than loops or over-the-lane configurations. Whether the accuracy lost is significant depends on the use of the data and the traffic mix at the detector location. Over-the-lane configurations generally have the greatest accuracy and can provide speed, volume, or occupancy data from a single detector per lane.

Advantage

Current technology offers out-of-pavement options for both permanent and temporary vehicle counting. A network of detectors can usually be designed for just about any budget.

Disadvantage

Detectors have ongoing maintenance and operating costs. They also require some sort of operating system to manipulate and store the information once it is collected. Detectors can also be a source of traffic flow interruption during some aspects of detector construction and maintenance.



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Figure 3.6
RVD SIDE-FIRE
POLE-MOUNT DETAIL

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Detection Costs

The following table presents the estimated costs for installing radar detectors (mounted to existing structures unless otherwise noted):

RVD Costs	Typical Unit Cost (per each)
4-Lane Side-Fire	\$10,000
8-Lane Side-Fire	\$14,000
4-Lane O-H	\$20,000
4-Lane O/H (New Structure)	\$60,000
8-Lane O/H (New Structure)	\$94,000

3.2.4 Dynamic Message Signs

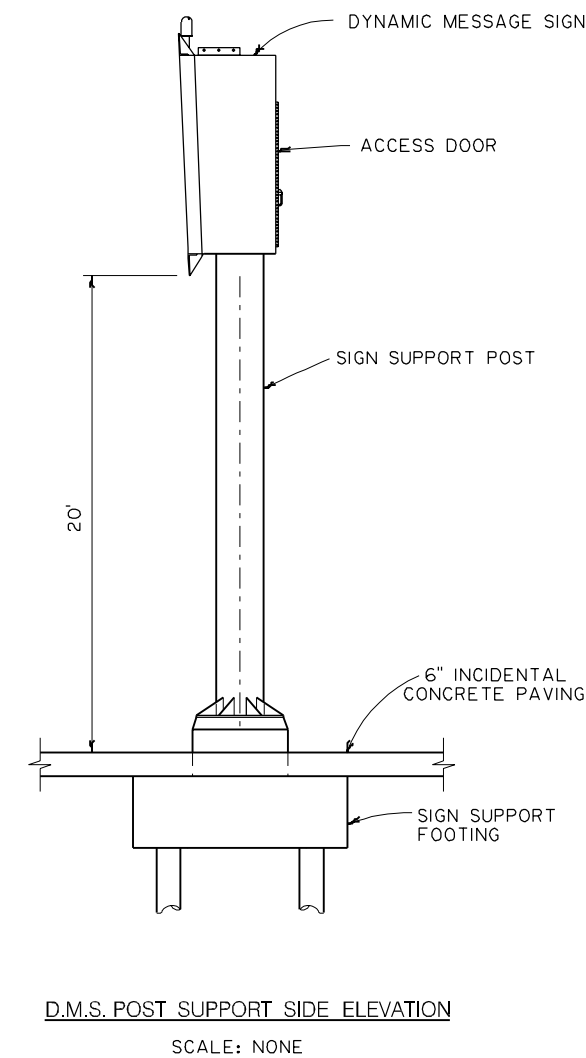
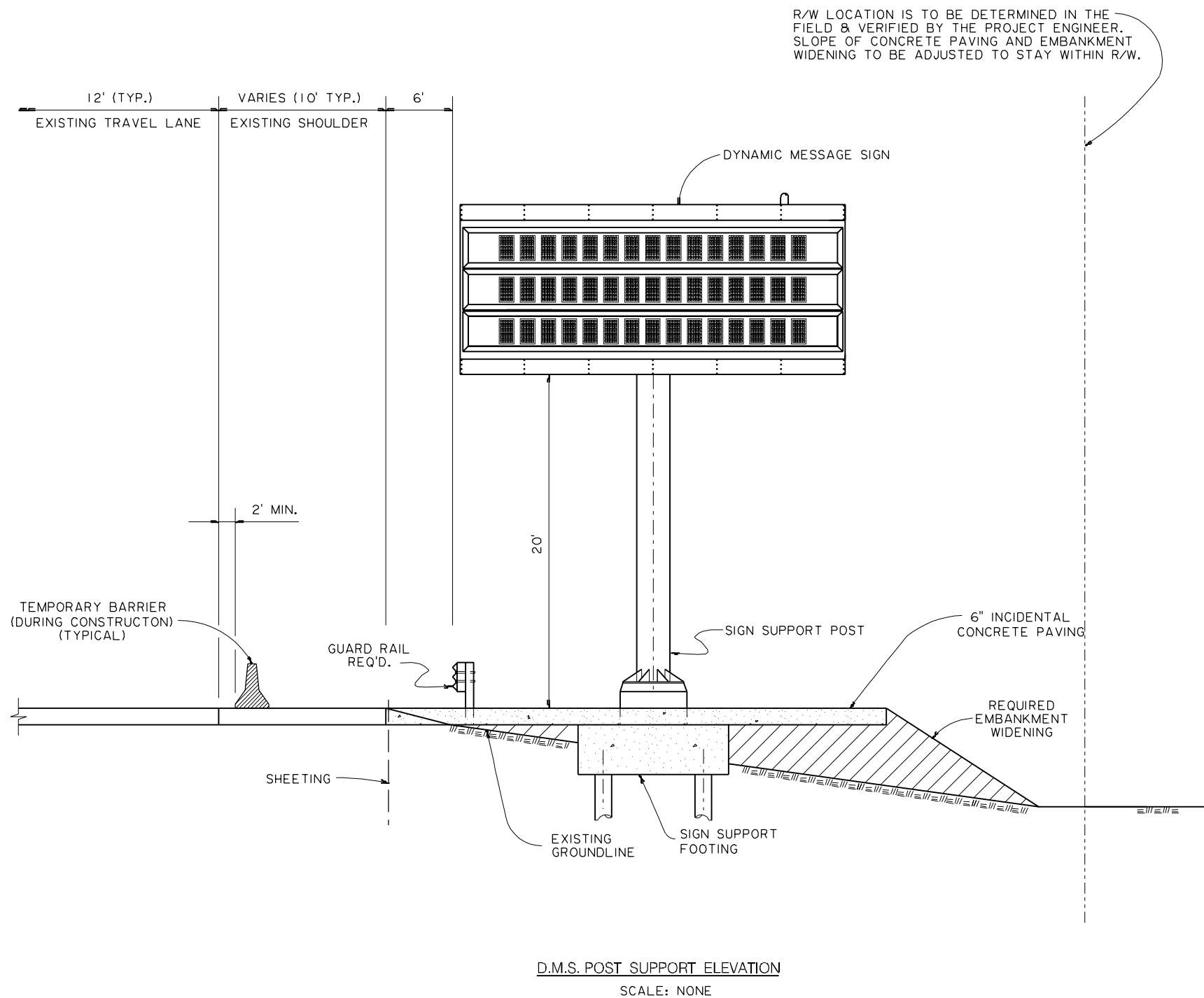
Dynamic message signs (DMSs) (see **Figure 3.7**) will be one of the primary means of disseminating information to motorists, especially en-route information. The costs for deploying DMS will vary greatly depending on the display size, display format, type of sign enclosure, display technology, and power backup system selected.

Display size generally indicates the number of rows and number of characters per row that make up the sign face. The display format may be multiple line or full matrix. Multiple line DMSs use 2, 3, or 4 lines of characters (text or special graphical characters) with space between the lines. A full matrix sign is one large display that may display text or graphics without line breaks in the display. In general, a full matrix sign costs more than a multiple line sign. Part of the cost difference is because a full matrix sign requires a walk-in cabinet sign enclosure.

With a walk-in cabinet enclosure the modules and electronic boards that make up the sign are maintained from within the sign enclosure. Most multiple line DMSs are maintained from outside the sign using a bucket truck or catwalk. The walk-in enclosures are larger and heavier which also increases the cost of the supporting structure. However, the walk-in enclosure tools are never dropped over traffic.

DMS Display Technologies

Several technologies are used to display messages including flip disk, light emitting diode (LED), fiber optic, hybrid flip disk/LED, and hybrid flip disk/fiber optic.



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Figure 3.7
DMS POST-MOUNT DETAIL

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Flip disk technology has seen wide spread use for many years. Flip disk signs use a matrix of disks (sometimes cubes) that are black on one side and have a reflective face, usually yellow or white, on the other side. Each disk is attached to an axle with a magnet. Electrical impulses are used to flip the magnet from North to South and thereby flip the attached disk from black to yellow. Flip disk signs only use power when flipping dots. The magnet keeps the dot black or yellow until the magnetic field is changed. A problem with flip disk signs is that dots have a tendency to become physically stuck on one position or the other.

LED signs use a matrix of LED's that are turned on or off with a continuous draw of power when on. LED signs have no moving parts and should be less expensive to maintain. LED signs have not seen widespread use for long enough to draw definitive conclusions regarding their long-term operation and maintenance costs.

A fiber optic sign uses a matrix of fibers, with a lens on the display end, routed to a few incandescent bulbs that provide light for the entire sign. A shutter mechanism covers or uncovers each fiber to allow light through the fiber to light the sign. The main maintenance drawbacks with fiber optic signs are that the shutter mechanisms can fail, light bulbs burn out, and fibers yellow over time, which allows less light through the fiber.

A power backup system is either a battery system or an emergency generator. Neither is inexpensive to install nor maintain. However, there may be locations deemed critical enough to require a power backup system. Decisions regarding power backup systems vary depending upon local requirements. This cost estimate assumes that no power backup system is desired.

Advantage

As mentioned above, these devices are probably the most effective information delivery system available today. Strategically placed and remotely controlled they can prepare drivers for unexpected conditions, promote diversion to other routes, alert motorists about future road construction events, and alert motorists to sudden weather emergencies. They are reasonably cost effective when deployed properly.

Disadvantage

They require some maintenance, operational costs and must be carefully controlled to maintain public confidence in the messages. Their messages are limited to only a few words presented in less than 7 seconds.

Typical DMS Costs

The costs for deploying DMS will vary greatly depending on the display size, display format, type of sign enclosure, display technology, and power backup system selected. The following table presents ballpark costs for DMS excluding the cost of sign support structures.

Display Size	Display Format	Sign Enclosure	Technology	Typical Unit Cost (per each)
14 – 18 inches Char/Line	3-Line	Not Walk-in	Flip Disk	\$30,000
14 – 18 inches Char/Line	3-Line	Not Walk-in	LED	\$60,000
14 – 18 inches Char/Line	3-Line	Not Walk-in	Flip / LED	\$60,000
14 – 18 inches Char/Line	3-Line	Not Walk-in	Flip / Fiber	\$70,000
14 – 12 inches Char/Line	3-Line	Not Walk-in	LED	\$40,000
14 – 12 inches Char/Line	3-Line	Not Walk-in	Flip / LED	\$40,000
14 – 18 inches Char/Line	Full Matrix	Walk-in	Flip Disk	\$75,000
14 – 18 inches Char/Line	Full Matrix	Walk-in	LED	\$130,000
14 – 18 inches Char/Line	Full Matrix	Walk-in	Flip / Fiber	\$120,000

3.2.5 Dynamic Message Sign Structure Costs

The DMS sign structure types typically considered include:

- Post structures
- Butterfly structures
- Median full span structures

Butterfly sign structures have a single supporting post with small equal length arms near the top of the post. Without the sign mounted to the structure, it looks similar to a lower case “t” with two cross arms instead of one. The DMS is mounted to the arms and the central supporting post, with a typical mounting height of 20 feet.

Median span structures and full span structures are typical overhead sign structures with uprights on either end and a truss or pole spanning over traffic between the uprights. A median-span structure spans only one direction of travel and has signs for direction of travel only. A full-span structure spans both directions of travel and has signs mounted for both directions. Cantilever sign structures would be cheaper than span structures; however, there has been some concern with cantilever sign structures and DMS because of uplift on the signs. Wind and updrafts from traffic (particularly tractor-trailer trucks) can push up on the bottom of the DMS enclosure. This

creates oscillations, which are not accounted for in standard sign structure designs. Thus, it is assumed that cantilever sign structures will not be used.

DMS Structure Costs

The following table presents ballpark costs for DMS support structures.

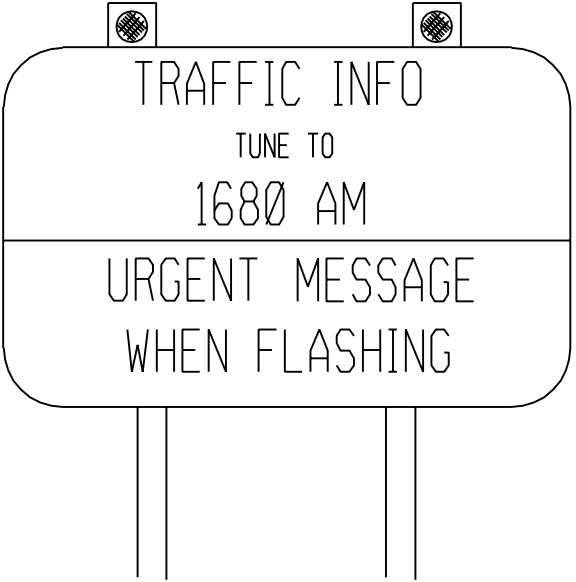
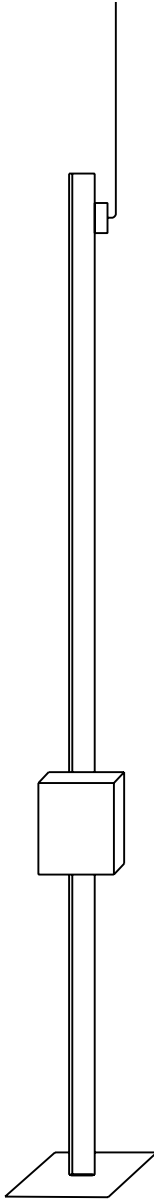
Structure Type	Typical Unit Cost (per each)
Post Mount	\$25,000
Butterfly	\$40,000
Full Span	\$50,000
Median Span	\$75,000

3.2.6 Highway Advisory Radio

A Highway Advisory Radio (HAR) system (see **Figure 3.8**) is capable of providing a relatively economical means of disseminating significant amounts of information on alternate routes or traffic conditions facing the motorist. Its use is intended to provide more specific traffic information at key locations on an immediate basis than is possible through traditional commercially broadcast traffic reports. The information content of a HAR message can be much greater than that displayed on a changeable message sign, and can utilize either live messages, pre-selected tape messages, or synthesized messages based on information for the traffic management system.

Highway advisory radio can use either 10 watt transmission or a low power transmission technologies. The 10 watt system requires an FCC license. When properly maintained and installed 10 watt transmitters have a broadcast radius of approximately three to five miles. FCC rules permit broadcasts on any frequency between 530 KHz and 1710 KHz. However, recent FCC rulings have also opened up the former dedicated traveler information (HAR) frequencies (530 KHz and 1610 KHz) to commercial broadcasting. Therefore, the potential for interference from commercial broadcasters has increased. The 10-watt HAR zone of influence is radial, so several adjoining 10-watt transmission zones may result in interference problems in the outer reaches of each broadcast radius.

The alternative to the 10-watt operation is a series of low power 0.1-watt transmitters, each of which is interconnected and synchronized to form a zone. Because of their low power, no FCC license is required. The major advantage with the low power concept is that transmitters may be arranged in a zonal configuration, allowing unique messages to be broadcast within each zone. This means that transmitted messages are relevant to that zone only, and invalidates the criticism of more traditional wide area advisory radio (i.e. 10 watt or commercial radio) that the motorist must listen to a number of messages before receiving one pertinent to their location.



NOT TO SCALE



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Figure 3.8
HAR STATION & SIGN

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The relatively low signal strength must compete with a variety of obstacles, including overpowering commercial broadcasts, signal skip (particularly at night), and poor signal propagation. These difficulties can be overcome by saturating an area (zone) with multiple transmitters. However, this concept is relatively new and has never been fully implemented, so a number of problems still exist.

A 10 watt system consisting of four transmitters is recommended as an initial element of the traffic management system. Transmitters should be located at the fringe areas of the freeway system. With a 3 to 5 mile range provided by each transmitter, HAR messages could provide significant coverage of the freeway system.

It is also recommended that the system include flashing beacons or similar advisory tool that are activated only when a message of some predetermined level of importance is being broadcast. Signs attached to the flashing beacon should include a legend such as "IMPORTANT MESSAGE WHEN FLASHING" or other advisory message. In this manner the freeway system can continuously broadcast default messages in each zone, and then turn on the flashing beacons whenever an urgent/emergency message is being broadcast. This prevents motorists from tuning to the HAR frequency, only to hear the default message time and time again. A situation that could negatively affect system credibility, the DMS could also be used to complement the HAR by providing initial information and advising the motorist to tune into the HAR, and thus replace the flashing beacons.

The following table indicates the cost of both the 10 watt and 0.1 watt Highway Advisory Radio (HAR) transmitters with associated hardware. This estimate does not include system integration or the configuration of the software to operate the system. The cost estimate for the 10-watt transmitter does not include the cost to obtain a FCC license.

Advantage

Almost every vehicle has an AM radio that can be used as an in-vehicle communication device and the cost of these stations is reasonable.

Disadvantage

Many motorists will not turn off their regular stations or CD players unless they have strong reason to suspect that the AM station has some valuable information for them.

Typical Highway Advisory Radio (HAR) Cost

The following table presents cost for HAR stations.

Highway Advisory Radio	Typical Unit Cost (per each)
10 watt transmitter includes associated equipment and system software	\$65,000
0.1 watt transmitter includes associated equipment and system software	\$20,000

3.2.7 Weather Stations

Roadway Weather Information Stations (RWIS) (see **Figure 3.9**) have many different features and range in price from \$12,000 to \$35,000 depending on the options chosen. One weather station will serve an area of approximately 10 miles. These systems can be integrated to work with the Highway Advisory Radio system and the Variable Message Signs to disseminate weather information to motorists.

Standardized Weather Station System features include:

- Temperature
- Humidity
- Barometric Pressure
- Wind Speed and Direction
- Visibility

Advanced Weather Station System options include:

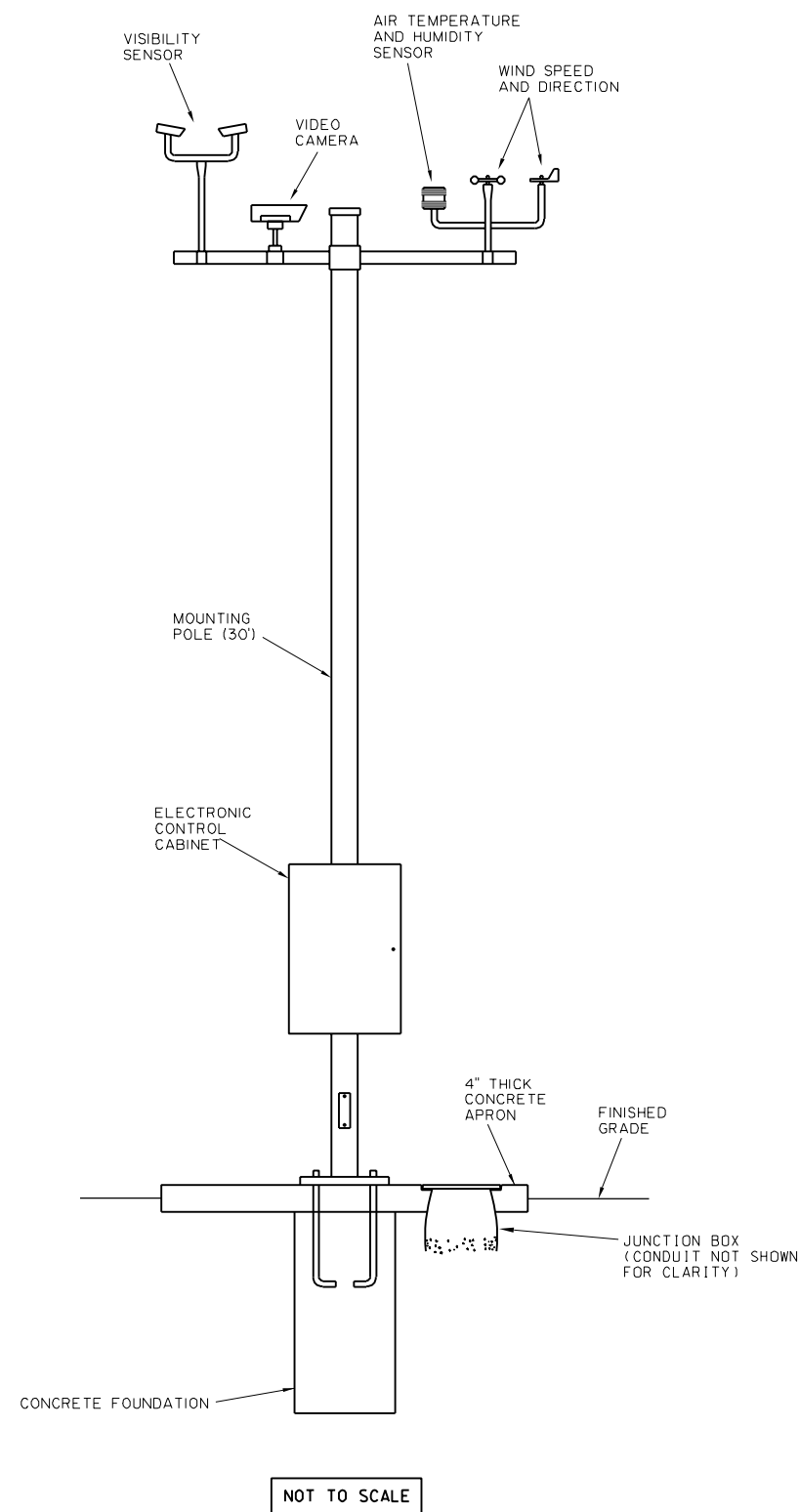
- Alarms to alert personnel to the presence or likelihood of a critical situation, developing on the road surface, (i.e. “hazardous” weather, traffic congestion, incident congestion).
- On-site video - Road sensors to measure road surface conditions (i.e. heat, snow, rain, etc.)

Advantage

Information can be shared with neighboring agencies to develop weather predictions that can become very critical during adverse weather events. They are probably most useful for efficiently dealing with snow and ice conditions.

Disadvantage

These systems have primarily been used for winter activities, making warm weather monthly service charges costly. Clearly defined procedures also need to be in place or the information becomes non-productive.



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Figure 3.9
WEATHER STATION DETAIL

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The following tables present costs for the weather stations.

Standard Weather Station	Typical Unit Cost (per each)
Weather Station includes associated equipment and system software	\$12,000

Advanced Weather Station	Typical Unit Cost (per each)
Advanced Weather Station includes associated equipment and system software	\$35,000

3.2.8 Traffic Signal System Improvements

The proposed improvements entail the upgrading, replacement and installation of traffic signal system equipment to improve traffic flow coordination within and between systems. This is envisioned to include new Advanced Transportation Controllers (ATCs) (e.g. 2070s), and necessary software, interconnect, and in-field communications equipment.

Advantage

Substantial benefits to traffic flow can be realized through incremental upgrade/replacement of legacy systems.

Disadvantage

Coordination with the local agencies is needed to determine the required traffic control standard (e.g. NEMA TS-2 or 2070) and to establish procurement and coordination procedures.

Typical Traffic Signal System Improvement Cost

Traffic Signal Control Systems	Typical Unit Cost (per each)
Traffic Signal System Improvements (per signalized intersection)	\$20,000 to \$100,000

3.2.9 Website

Websites (see **Figure 3.10**) can serve many purposes. They can be a means for giving the public information about upcoming construction, information about current traffic conditions, maps, related motorists services information, and they can also provide an opportunity for the public to provide feedback to the DOTD about issues that affect the public perception of their services. Secured websites can also be used as bulletin boards for interagency document transactions. A very effective use for Websites is the distribution of CCTV images to the media and to the public.

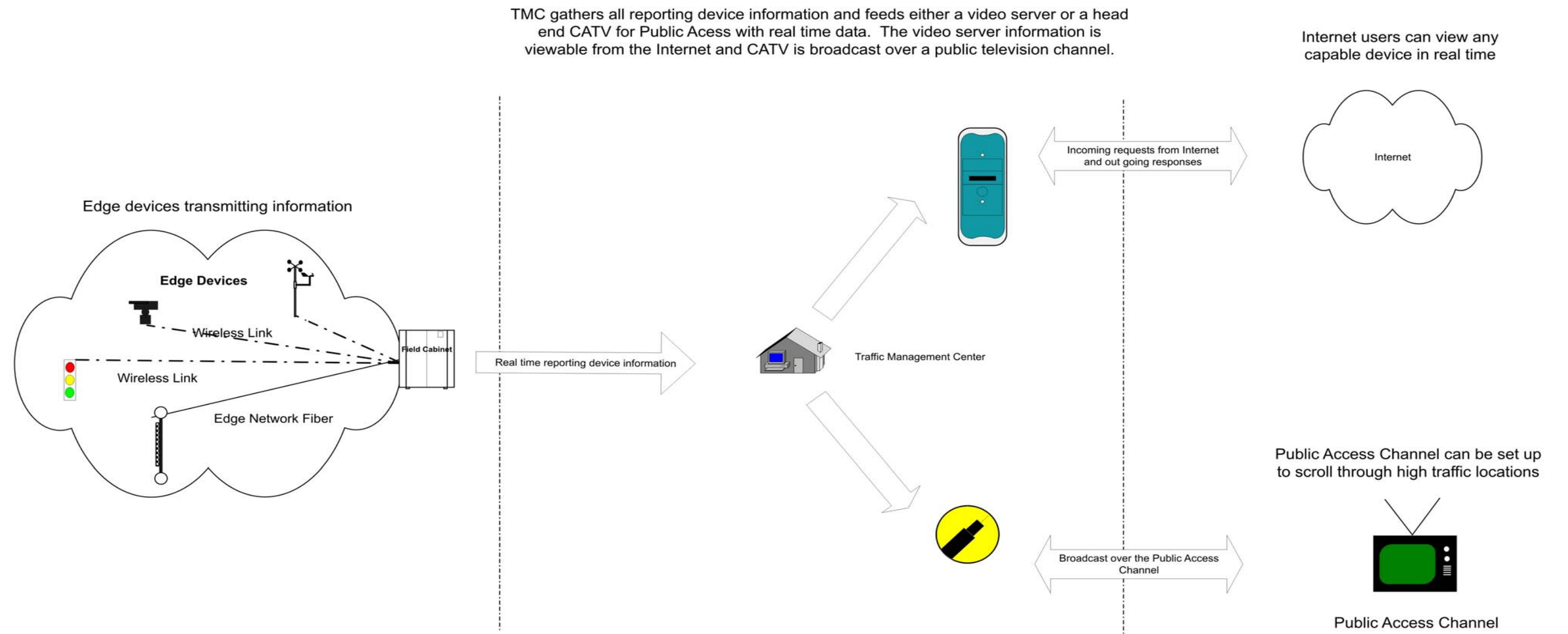


Figure 3.10 Website & Public Access Channel

Advantage

Websites can be a powerful tool for promoting optimal flow.

Disadvantage

Web sites need to be created professionally, and they need to be kept very current or public confidence will wane.

Typical Website Cost

The following table presents cost for a Website. (Note that the cost could be significantly less depending on the required features and whether or not custom software is used.)

Website Cost	Typical Unit Cost (per each)
Web site includes associated equipment and system software	\$150,000

Another means, perhaps in conjunction with the website, for providing the public information about traffic conditions (i.e. current traffic conditions, construction information, maps, and related motorist services information) is via cable television. This can be a cost-effective means for the DOTD to provide traffic information. In most jurisdictions, federal guidelines require access to one or more public channels. In many communities a public access channel can be utilized to carry traffic information exclusively or during peak hours.

Advantage

This is a low cost solution that can reach a wide range of the driving public.

Disadvantage

The information provided needs to be kept very current or public confidence will wane.

Typical Cable Television Access Cost

The following table presents cost for Cable Television Access.

Cable Television Access	Typical Unit Cost (per each)
Cable Television Access (includes associated equipment and system software)	\$75,000

3.3 Guidelines for Traffic Control Systems Deployment

The proposed ITS deployment targeted by the stakeholders for Immediate-Term implementation consists exclusively of traffic control system improvements, primarily controller assembly upgrades and replacement. This section presents guidelines for that process.

The upgrading of traffic control systems is an ongoing process. As older equipment reaches the end of its useable life, the replacement process should bring the equipment up to the agency's current minimum standards. The upgrading and expansion of signal systems in corridors of regional significance can improve traffic flow through efficient and responsive timing plans and the ability to respond more effectively to incidents.

The traffic control replacement, upgrade, and expansion process should support future Intelligent Transportation Systems (ITS) enhancements and promote the interoperability and interchangeability of traffic control equipment. This document presents important issues and considerations in four key areas related to ITS and traffic control systems: Field Hardware and Firmware, Communications and Protocol, Systems Architecture, and Maintenance and Operations. It is intended to serve as a guideline for affected agencies and stakeholders within the Shreveport/Bossier City region.

3.3.1 Field Hardware and Firmware

The replacement process should bring the field equipment and functionality up to the agency's current minimum standards. Field equipment replacement can also provide enhancements beyond the minimum standards to incorporate new features and abilities, which will improve traffic flow and maintenance.

Upgrading of field hardware for signal systems includes the enhancement of signal controllers and cabinets at individual intersections, as well as the communications equipment that responds back to a monitoring location. This upgrade should provide a minimum level of safety and operation at each signalized location. This could include replacement of traffic signal assemblies that do not have conflict monitor or malfunction management units (MMUs) overseeing the signal operations.

One issue to consider is the utilization of a single controller or software package throughout the region. This might be advantageous for many reasons, the first being coordination of signals. Coordination within and between jurisdictions could be easily facilitated utilizing this approach. Other benefits include that the maintenance and operations personnel would have only one controller or software package to become familiar with, and the ability to acquire regional pricing from larger controller quantity purchases.

The ability to predict what the future ITS devices will be and what support they will need can be difficult to predict. We can, however, provide a platform that meets all current and projected support functions and has a path to allow systematic updates to ensure future compatibility. The functionality needs to be supported both by the field equipment as well as the central monitoring equipment. All of the new model controller standards can support a number of functions. An

example of these traffic control standards are the NEMA TS-2 (Type 1 and Type 2), 2070, and the Advanced Transportation Control (ATC) controllers. Minimum functions typically supported include:

- Remote upload/download
- System detection counts and storage
- Alarm reporting
- Remote manual plan selection
- Responsive/adaptive automated plan selection/generation
- Emergency vehicle preemption (high priority)
- Low priority transit preemption

The methods to achieve this functionality and minimize the integration issues sometimes involves the field equipment utilizing either an open protocol or an agency-licensed protocol on an open hardware platform. An open hardware standard has its own advantages and disadvantages. An example of an open hardware standard is the 2070 platform. This type of standard allows the agency to have a licensed software package that can be installed in any manufacturer's 2070-compliant controller. This allows the database of the controller to be standardized throughout the signal system regardless of controller manufacturer. This approach allows complete interchangeability between different manufacturers controllers. This allows subsequent equipment bids to interface with the existing central control system by utilizing the agency's software package regardless of the controller manufacturer. The upgrading of a system with an open hardware standard allows just a single software package to be upgraded without hardware replacement. Some key field hardware and firmware issues and considerations are summarized in **Table 3.6** below.

Table 3.6 Field Hardware and Firmware Issues & Considerations

Issue	Considerations
Controller replacements	Replace by each agency or multi-agency bid package?
	Compatibility with existing centralized system?
	Compatibility with existing field hardware (e.g. controller cabinet)?
	Performance / hardware standard preference: NEMA, 2070?
	Common software package for the region (single manufacturer or agency-licensed)?
	Interoperability and/or interchangeability?
	Functionality needed to support the system?
Other hardware replacements	Cabinet equipment upgrade to include conflict monitors or MMUs (including replacement of electromechanical controller cabinets)
	Replacement of cabinets and/or equipment based upon maintenance issues?
	Cabinet replacement of solid-state fixed-time controllers to be compatible with new controllers
	Replacement of controller cabinets to achieve additional functionality/capacity? (including detector inputs)

3.3.2 Communications and Protocol

Upgrading of a traffic signal system includes the enhancement of signal controllers, the communications back to a monitoring location, as well as the monitoring location itself. Communication upgrades can allow staff to be apprised in real-time of changing conditions and incidents, thus allowing more effective management through the ability to change parameters in field devices from a remote location.

The protocol utilized needs to support the complete functionality required by the system. Enhancements to the functionality of the system typically requires an update of the communications protocol at both the field devices and at the central monitoring locations. The modification of an existing protocol or installation of a new protocol requires extensive testing of both the central system and field equipment before implementation. If multiple protocols or communication packages are utilized, then a testing process is required for each. This testing process needs to occur, each time a manufacturer updates the controller firmware to ensure compatibility with the existing system.

An open protocol has advantages and disadvantages. An example of an open protocol is the National Transportation Communications for ITS Protocol (NTCIP). The controller manufacturers can use NTCIP to manage all of the functions of the controller. Each controller has a unique database that contains the parameter settings for all of its functions. NTCIP helps signal controllers to be functionally interoperable, but not necessarily physically interchangeable, when utilizing features and functions specific to a manufacturer. The control system would also need to be programmed for each controller database. Future bid packages would need to specify an existing controller, where the control system already has the database included, or the control system software would need modification to utilize the new controller's database.

The communication links required to support ITS functions are both low and high bandwidth. An example of a high bandwidth communications link is that required to support Closed Circuit Television (CCTV) surveillance images transmitted from the field to the monitoring site. The communications requirements of a traffic signal control system are typically low bandwidth.

The amount of data sent in a single status message is not typically the constraining factor; it is the frequency of the data sent. Most signal control systems communicate once per second to check the status of each signal controller. This transmission is typically 5-8 bytes of information. The uploading or downloading of information to the controller is the greatest amount of data transmitted during any interaction between the control system and the controller. However, as the level of sophistication increases, so does the required supporting infrastructure. If and when the opportunity presents itself to achieve a higher bandwidth communications infrastructure, agencies should consider dedicating this infrastructure for future traffic control usage. Some key communications and protocol issues and considerations are summarized in *Table 3.7* below.

Table 3.7 Communications and Protocol Issues & Considerations

Issues	Considerations
Protocols	System support for an open or proprietary protocol?
	System support for single or multiple software packages?
	Agency-owned software package on open hardware package?
	System protocol upgrade path
Communications	Agency-owned infrastructure or leased services?
	Communications hubs or centralized distribution location?
	Future needs?

3.3.3 Systems Architecture

Upgrading of traffic control systems also consists of the enhancement of the monitoring methods and support at the monitoring location. This section discusses different methods of controlling and monitoring field devices.

Control and Monitoring Methods

There are multiple types of traffic signal control systems that can support the region. Two types are central control and distributive control. Each can support ITS functions, however, they achieve this support in different ways. The fundamental difference is in the implementation of the commands from the control system. In the central control system scheme the central system retains all of the plan information at the central location and issues commands to control the intersection. The operators at the central system can utilize any plan contained in the central system or create a new plan. The scheme relies heavily on the communications infrastructure. The disadvantage of this scheme is that, in the event of a communications failure, the intersection will revert back to local control. The local control timing plans and time-of-day plans are typically not as up-to-date as the central control plans, and the clock for time-based control functions can differ from the central system's reference clock.

The distributive control system downloads all of the plans to the local controller and does not rely on the communications infrastructure for controlling each movement. This system allows the central monitoring location to select plans already downloaded to the local controller or download new plans on an as-needed basis. The distributive control system is not as affected by the loss of communications since all plans and time-of-day tables are contained and implemented locally. The disadvantage of the distributive control system is that each signal controller is

referencing an internal clock. These internal clocks can drift slightly and should be updated from a common reference point at least once a day.

Regional Monitoring Location Considerations

The signals and ITS equipment in the region can be controlled and monitored by a single control system or by multiple control systems. The multiple control systems can be linked together using center-to-center communication strategies. The linking of the centers allows the sharing of information and improved coordination across jurisdictional boundaries. Center-to-center communications allows the multiple systems to react to manual and time-of-day events in a coordinated manner. The disadvantage occurs when the multiple systems scenario is in a responsive or adaptive mode. These modes utilize and respond to information from the system's detectors and controllers. Each system responds independently and might not advise acceptable cross-jurisdictional coordination.

Utilizing a single system is not so much a technical issue, as a political issue of involving multiple agencies and jurisdictions. Regional coordination and monitoring involves control and liability issues including having non-agency personnel interacting with an agency's equipment. Policies and procedures can give regional control center staff the authorization to control or make adjustments to all participating agency's equipment. This can also include a regional maintenance staff or coordinated maintenance effort. Some key systems architecture issues and considerations are summarized in **Table 3.8** below.

Table 3.8 Systems Architecture Issues & Considerations

Issue	Considerations
Control and monitoring methods	Centralized control or distributive control?
	Field masters?
	Remote communication hubs?
Control and monitoring locations	Single multi-agency regional control center or multiple control centers?
	Inter-agency agreements for information sharing and control of traffic signals?

3.3.4 Maintenance and Operations

Signal system upgrades can enhance and simplify maintenance and operations. Using controllers of the same brand or software package throughout the region is advantageous because maintenance and operations personnel only have a single software package to become familiar with.

The open hardware (2070) approach allows complete interchangeability between different manufacturers controllers. This reduces the inventory of replacement parts needed to repair and maintain the controllers. This approach also increases the effectiveness of the technicians to familiarize themselves with the troubleshooting of the controller and other field equipment.

The signal system upgrade can provide a basis for arterial street incident detection and management. A signal system utilizing system detection at regular spacing can monitor both the volume and speed of vehicular traffic. This information can be compared to thresholds or

historical data and various alarm outputs can be generated upon recognition of an event or incident. The outputs can alert personnel either on-screen or by a paging method. These outputs can activate a CCTV system to record from a preset position and camera based upon the location indicated by the alarm. The system can also utilize this information to react in a responsive or adaptive mode.

The enhancements can include the ability of a field technician to request an unassisted download from the central control system to the signal controller. The technician accessing the keypad of the field controller initiates this download. This feature is extremely useful for the technician who replaces a controller during hours that the central control system site is not staffed.

The enhancements can also include automated system failure reporting to alert operational personnel of failures or events in the field. This reporting ability allows the proper personnel to be dispatched faster and with prior knowledge of the nature of the failure. Personnel can then respond with the needed replacement part or call for assistance. The automated reporting can utilize a paging system that contacts personnel during non-staffed hours. The paging system accesses various lists of personnel depending on the nature of the failure. The time-of-day and the seriousness of the failure can also be used to filter and control this feature. Some key maintenance and operations issues and considerations are summarized in **Table 3.9** below.

Table 3.9 Maintenance and Operations Issues & Considerations

Issue	Considerations
Maintenance	Multiple software packages?
	Replacement controllers/parts?
	Auto-failure reporting?
	Field-requested downloads?
Features	Arterial incident management?
	Paging ability?

3.3.5 Traffic Control Standards

The current State Controller Standard is NEMA TS-1. DOTD has established a task force to evaluate the costs and benefits associated with changing the standard to NEMA TS-2 or 2070. DOTD District 04 and the Cities of Shreveport and Bossier City have expressed their desire to the task force that an emphasis be placed on controller/equipment interchangeability, that is, an open architecture (non-proprietary) approach allowing, for example, multiple manufacturers operating seamlessly within a single system.

Tables 3.10 and **3.11** summarize an objective comparison of the available traffic control standards provided to the DOTD task force.

Table 3.10 Comparison of Traffic Control Standards

Issue	NEMA TS-1 Standard	NEMA TS-2 Standard ⁸	2070 Standard ⁹
Source of Standard	NEMA	NEMA	ITE, AASHTO, FHWA, NEMA
	First major standard for traffic signal assemblies	Upgrade and enhancement to the NEMA TS-1 Standard	Part of the ATC family of controllers
Purchase Price	\$1,500 for typical traffic controller assembly	\$2,000 for typical traffic controller assembly	\$4,500 for typical traffic controller assembly (including software)
	Sold as traffic signal controller hardware and software	Sold as traffic signal controller hardware and software	Sold as a hardware package with or without a software package ⁵
Applications	Basic traffic signal control ¹	Traffic signal control including: time-of-day functions, communications, preempt operation, and coordination are specified by the standard ¹	Open software architecture. Software packages can provide a variety of applications. Software packages currently offered are similar to TS-2 offerings.
Monitoring Characteristics	Monitors for conflicts between greens, yellows and walks ¹	Monitors for conflicts between controller and other subassemblies ¹	Monitors for conflicts between controller and other subassemblies ¹
Controller Intercompatibility	Compatible with other TS-1	Compatible with TS-1 and TS-2 ²	Compatible with TS-1, TS-2, 170 and 2070 ²
System Compatibility	RCU interface is proprietary to system ¹	Proprietary only to achieve complete up and download ³	Complete interchangeability utilizing a single system software package ⁴
Physical Characteristics	Functional pin out only	Functional pin out only	Complete hardware and operating system specified
Controller / Subassembly Interface	All input and outputs are hardwired	Inputs and outputs can be hardwired or serial bus interface ²	Inputs and outputs can be hardwired or serial bus interface ²
Controller Unit Expansion	None ¹	Additional modem interface cards ¹	Expansion capabilities for other processing and remote functions ¹
Cabinet Expansion	None ¹	Serial interface allows for plug and play expansion of auxiliary devices	Serial interface allows for plug and play expansion for auxiliary devices
Technological Advances	State-of-the-art Manufacturer can update at anytime ⁶	State-of-the-art Manufacturer can update at any time ⁶	Hardware and operating system are specified by standard
Maintenance and Operations	Easiest to troubleshoot	Cabinets utilizing serial interfaces increase complexity of troubleshooting ⁷	Cabinets utilizing serial interfaces increase complexity of troubleshooting ⁷
	Operates in TS-1 environment only	Single controller unit hardware platform for TS-1 and TS-2 cabinet types ²	Single controller unit hardware platform for multiple cabinet types ²
Future Purchases for System Control with download feature	None ¹	Manufacturer and model specific to achieve complete compatibility ³	Open to all 2070 compatible controller units. Hardware is completely interchangeable utilizing a system software package ^{4,5}

1. Some manufacturers offer features and functions beyond the standard.
2. A properly configured controller with appropriate software.
3. Most systems have proprietary protocol. NTCIP-based systems still have manufacturer-specific information for a complete database transfer.
4. This assumes a 2070 software package has been incorporated in the system.
5. Software packages can be purchased from third-party vendors. Software can be licensed to agencies for installation in up to a specified number of controller units.
6. Manufacturer updates may not be compatible with existing system software for an earlier version.
7. Cabinets may be constructed in a TS-1 hardware configuration (non-serial bus).
8. NEMA TS-2 offers two approaches ('Type 2' is assumed for comparison purposes):
 'Type 1' utilizes a high-speed data channel between all major equipment to maximize functionality and expandability.
 'Type 2' is essentially a Type 2 plus MSA, MSB, and MSC connectors for data exchange with the rear panel to provide a degree of downward compatibility.
9. A "2070 Lite" controller (without a VME bus) is assumed for comparison purposes.

Table 3.11 Traffic Control Standards Comparison Summary

Issue	NEMA TS-1 Standard	NEMA TS-2 Standard ⁸	2070 Standard
Purchase Price	●	⊙	○
Applications	⊙	●	●
Monitoring Characteristics	⊙	●	●
Controller Intercompatability	○	⊙	●
System Compatibility	○	⊙	●
Physical Characteristics	⊙	⊙	⊙
Controller/Subassembly Interface	⊙	●	●
Controller Unit Expansion	○	⊙	●
Cabinet Expansion	○	●	●
Technological Advances	●	●	⊙
Maintenance and Operations	●	⊙	⊙
Future Purchases for System Control with download feature	○	⊙	●

Legend: Fair ○ Good ⊙ Best ●

3.4 Fiscally-Constrained Deployment

Specific funding earmarks for the proposed Shreveport / Bossier City regional ITS deployment are identified in **Section 7.0** along with estimates of reasonable funding that can be anticipated over the 10-year horizon. Based on the reasonable anticipated funding levels, a financially-constrained deployment program is defined in this section.

The proposed “unconstrained” Shreveport / Bossier City ITS Strategic Deployment Plan presented in **Section 3.1** consists of:

- 579 RVDs
- 220 CCTV cameras
- 15 DMSs (not including 3 by others)
- signal system improvements at 395 intersections
- 10 weather stations
- 4 HAR stations
- Installation of trunk and distribution communications (fiber and wireless)

The estimated construction cost (not including design) for this full, unconstrained deployment (not including transit) is approximately \$85.3 million. The construction of the “fiscally-constrained” deployment (see **Table 3.12** for details) is estimated at \$50.3 million, for the Immediate/Near/Mid-Term Program (**Figure 3.11** and **Table 3.13a**) and \$35.0 million for the Long-Term Program (**Table 3.13b**). The Immediate/Near/Mid-Term fiscally-constrained deployment program illustrated in **Table 3.13a** includes the upgrade and integration of all traffic signals within the Cities of Shreveport and Bossier City and includes deployment along the critical segments of I-20, I-220 and I-49 within the region.

Note that each element of the proposed unconstrained deployment is considered important. The fiscally-constrained deployment program does not eliminate elements or systems. The total ITS Program construction cost of \$85.3 million remains the same. Selected elements are simply moved to the Long-Term Program so that critical coverage is provided in a timely manner within the Immediate/Near/Mid-Term Program, in the event of deployment constraints (e.g. limited construction funding). The fiscally-constrained plan prioritizes deployment components and density of device deployment consistent with the reasonable levels of anticipated funding over the 10-year horizon as defined in **Section 7.0**. At the same time an attempt was made to minimize implementation costs to the extent possible, without compromising the system integrity. All critical ITS system elements, including every surface street traffic signal in Shreveport and every Bossier City signal targeted for improvement, are addressed within the fiscally-constrained Immediate/Near/Mid-Term Program. Remaining improvements, such as additional upgrades and Weather Stations, are addressed in the Long-Term Program. The fiscally-constrained deployment program, schedule, and costs are summarized in **Table 3.14**. **Table 3.15** summarizes the financially-constrained deployment plan, including prioritized projects, costs, anticipated let dates, and funding sources. The transit deployment is summarized separately in **Table 3.16**.

The general approach used to fiscally-constrain the proposed deployment is as follows:

- Immediate term deployment is not constrained.
- RVD: The Immediate/Near/Mid-Term program retains RVD coverage at major interchanges and one mile along all controlled-access approaches to the major interchanges (total of 403 RVDs assigned to Long-Term).
- CCTV: Half of the controlled-access facility CCTV cameras (plus all CCTV cameras on I-20 outside of I-220) and all Shreveport surface street CCTV cameras (except Immediate-Term) are assigned to Long-Term (total of 119 CCTV cameras assigned to Long-Term).
- DMS: DMS deployment is not constrained.
- Signals: None of the signals are constrained. All signals are improved within the Immediate/Near/Mid-Term Program. The Long-Term Program includes additional upgrades of Shreveport signals.

- Weather: All weather stations are constrained (total of 10 weather stations assigned to Long-Term).
- HAR: Highway Advisory Radio deployment is not constrained.
- Communications: Trunkline and distribution communications deployment is not constrained.
- TMC: Interim (ITMC) and Regional (RTMC) deployment is not constrained.
- Software & Integration: Software implementation and systems integration is not constrained.
- Transit: Transit deployment is not constrained.

In addition, the RTMC deployment and the associated software/integration (originally Near-Term/Phase 3) are accelerated to Phases 2A and 2B. Thus, the system can better accommodate the substantial Near-Term/Phase 3 (originally Near-Term/Phase 2) deployment.

Please note that funding should continue to be pursued for the Long-Term Program components. If funding is secured for any of these components, and the Regional ITS Policy Committee is in agreement, deferred components can be implemented immediately.

Table 3.12 Fiscally-Constrained ITS Deployment

Deployment		Facility/Component			Proposed				
Timeframe	Phase	Name	Location	Type	RVD	CCTV	DMS	Signals	Weather
All	All	Primary (trunkline) communications	I-220 to LA 3105 to US 71 to LA 511 to LA 3132	Fiber optic					
		Secondary (distribution) communications	Field devices to trunkline	Hybrid fiber/wireless					
Immediate	1	LA 511	LA 3132 (East) to west of Gilbert Drive	Surface street		1		7	
		LA 3132	South of LA 511 (East) to LA 526	Surface street		6		7	
		LA 1	LA 523 to Gator Street	Surface street		3		9	
		McDade Street	US 71 to Arthur Teague Parkway	Surface street		1		2	
		LA 3	Riverwood Drive to Shed Road	Surface street				2	
	2	LA 526	West of LA 3132 to Flournoy and Lucas Road	Surface street				10	
		US 171	Williamson Way to LA 3132	Surface street				12	
		Jewella Road	West of US 171 to Meriwether Road	Surface street				4	
	3	LA 1	North of Gator Street to Lake Street	Surface street				11	
		LA 511	West of Gilbert Drive to West Canal Boulevard	Surface street				9	
		US 171	North of LA 3132 to south of LA 511	Surface street				2	
Near	1	I-20	I-220/LA 3132 to I-220 (East)	Controlled-access		15	5		
		I-20/I-220/LA 3132 interchange	-	Major interchange	20	2			
		I-20/I-49 interchange	-	Major interchange	16	2			
		I-20/LA 1 interchange	-	Major interchange	12	2			
		I-20/LA 3105 interchange	-	Major interchange	12	2			
		I-20/I-220 (East) interchange	-	Major interchange	16	2			
		Highway Advisory Radio stations	Four stations (sites to be determined)	10 watt					
		DOTD Interim TMC	Within existing DOTD District 04 office	Interim					
		Software & Integration	DOTD Interim TMC	Network management					
		Shreveport Interim TMC	Within exiting Shreveport Traffic Engineering office	Interim					
		Software & Integration	Shreveport Interim TMC	Network management					
	2A	RTMC	Site of existing DOTD District 04 office	Regional					
	2B	Software & Integration	RTMC	Traffic management					
	3	LA 3132/Linwood Avenue interchange	-	Major interchange	12	2			
		LA 3132/LA 523 interchange	-	Major interchange	12	2			
		LA 3132/LA 526 interchange	-	Major interchange	8	2			
		I-220	I-20/LA 3132 to I-20 (East)	Controlled-access		18	5		
		I-220/US 71/LA 1 interchange	-	Major interchange	12	2			
		I-220/LA 3105 interchange	-	Major interchange	12	2			
		I-49/LA 526 interchange	-	Major interchange	12	2			
		I-49/LA 3132 interchange	-	Major interchange	20	2			
	4	US 71/LA 1	LA 3194 to north of Lake Street	Surface street				21	
	5	Kings Highway	LA 3094 to west of LA 1	Surface street				17	
		LA 3032	East of LA 1 to US 71	Surface street		1		7	
		LA 511	US 71 to east of LA 3132 (East)	Surface street		2		3	
		US 79/80	LA 3105 to Murphy Street	Surface street		2		14	
		Murphy Street	West of US 79/80 to Allen Avenue	Surface street				3	
		LA 3	North of Riverwood Drive to Kingston Road	Surface street				4	
		LA 3	South of Shed Road to I-20	Surface street		1		5	
		US 71	I-20 to north of LA 511	Surface street				9	
		LA 3105	North of US 71 to Kingston Road	Surface street		3		11	

Table 3.12 Fiscally-Constrained ITS Deployment

Deployment		Facility/Component			Proposed				
Timeframe	Phase	Name	Location	Type	RVD	CCTV	DMS	Signals	Weather
Near	5	Shed Road	LA 3105 to east of LA 3	Surface street				1	
		Swan Lake Road	US 79/80 to Flat River Drainage Canal	Surface street		1		2	
	6	LA 3094	South of US 71/LA 1 to I-20	Surface street				10	
		US 171	South of I-20 to north of LA 511	Surface street				7	
	7	I-49	I-20 to 0.5 mile south of LA 526 interchange	Controlled-access		8	3		
Mid	1	LA 3132	I-20/I-220 to LA 526	Controlled-access		9	2		
		I-20/LA 526 interchange	-	Major interchange	12	2			
		I-20	I-220/LA 3132 to LA 526	Controlled-access		4			
	2 ⁽¹⁾	LA 511	LA 526 to west of West Canal Boulevard	Surface street				6	
		Pines Road	I-20 to north of LA 511	Surface street				3	
		Jewella Road	Lakeshore Drive to north of Meriwether Road	Surface street				12	
		Line Avenue	I-20 to Fournoy and Lucas Road	Surface street				17	
	3 ⁽¹⁾	LA 526	US 79/80 to west of Fournoy and Lucas Road	Surface street				4	
		LA 173	Parish Route 9 (Roy Road) to I-220	Surface street				1	
		Allen Avenue	Milam Street to I-20	Surface street				1	
		Linwood Avenue	I-20 to LA 523	Surface street				12	
	4 ⁽¹⁾	US 79/80	South of Murphy Street to Pines Road	Surface street				15	
		Hollywood Avenue	Monkhouse Drive to I-49	Surface street				8	
		Pierremont Road	East of I-49 to west of LA 1	Surface street				5	
		Southfield Road	East of LA 1 to East Kings Highway	Surface street				2	
	5 ⁽¹⁾	Shreveport signals	Central business district	Surface street				27	
	6 ⁽¹⁾	Murphy Street/Stoner Avenue	East of LA 3094 to east of LA 1	Surface street				7	
		Lakeshore Drive/Yarbrough Road	I-20 to Pines Road	Surface street				6	
		Pines Road	South of Yarbrough Road to Jefferson-Paige Road	Surface street				1	
	7 ⁽¹⁾	Shreveport signals	All remaining	Surface street				79	
Long	-	LA 526	West of LA 3132 to Fournoy and Lucas Road	Surface street		5			
	- ⁽²⁾	LA 526	US 79/80 to west of Fournoy and Lucas Road	Surface street				4	
	-	US 171	Williamson Way to LA 3132	Surface street		7			
	-	LA 1	North of Gator Street to Lake Street	Surface street		2			
	-	US 71/LA 1	LA 3194 to north of Lake Street	Surface street		8			
	-	LA 511	West of Gilbert Drive to West Canal Boulevard	Surface Street		3			
	- ⁽²⁾	LA 511	LA 526 to west of West Canal Boulevard	Surface street		2		6	
	-	Kings Highway	LA 3094 to west of LA 1	Surface street		4			
	-	LA 3094	South of US 71/LA 1 to I-20	Surface street		2			
	- ⁽²⁾	Pines Road	I-20 to north of LA 511	Surface street		3		3	
	- ⁽²⁾	Pines Road	South of Yarbrough Road to Jefferson-Paige Road	Surface street				1	
	- ⁽²⁾	Jewella Road	Lakeshore Drive to north of Meriwether Road	Surface street		3		12	
	- ⁽²⁾	Line Avenue	I-20 to Fournoy and Lucas Road	Surface street				17	
	- ⁽²⁾	LA 173	Parish Route 9 (Roy Road) to I-220	Surface street				1	
	- ⁽²⁾	Allen Avenue	Milam Street to I-20	Surface street				1	
	- ⁽²⁾	Linwood Avenue	I-20 to LA 523	Surface street				12	
	- ⁽²⁾	US 79/80	South of Murphy Street to Pines Road	Surface street				15	

Table 3.12 Fiscally-Constrained ITS Deployment

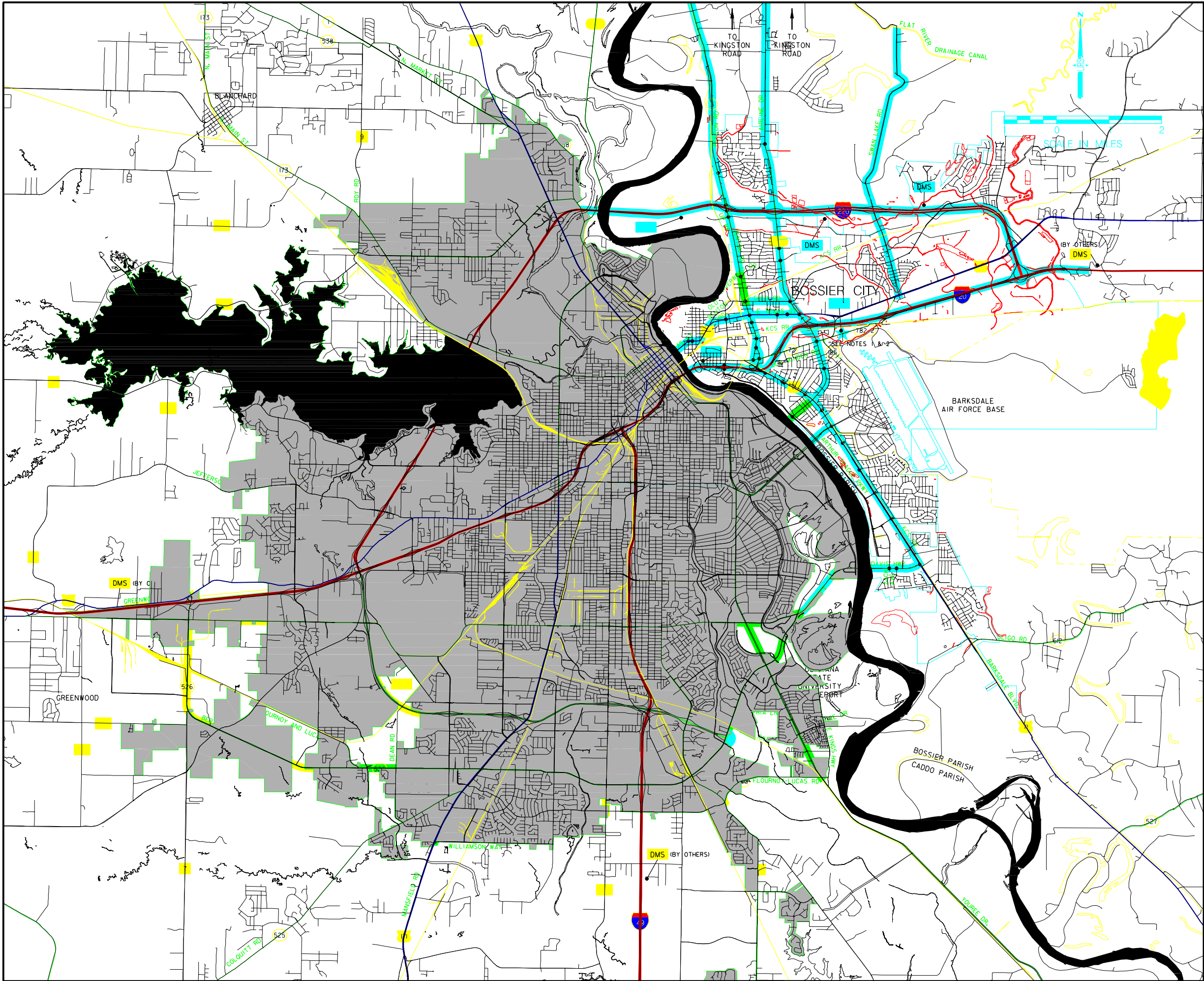
Deployment		Facility/Component			Proposed				
Timeframe	Phase	Name	Location	Type	RVD	CCTV	DMS	Signals	Weather
Long	-(2)	Hollywood Avenue	Monkhouse Drive to I-49	Surface street				8	
	-(2)	Pierremont Road	East of I-49 to west of LA 1	Surface street				5	
	-(2)	Southfield Road	East of LA 1 to East Kings Highway	Surface street				2	
	-(2)	Murphy Street/Stoner Avenue	East of LA 3094 to east of LA 1	Surface street				7	
	-(2)	Lakeshore Drive/Yarbrough Road	I-20 to Pines Road	Surface street				6	
	-(2)	Shreveport signals	Central business district	Surface street				27	
	-(2)	Shreveport signals	All remaining	Surface street				79	
	-	Weather stations	Various	Includes CCTV camera					10
	-	Regional Maintenance Facility	Site of existing DOTD District 04 office	Regional					
	-	I-220	I-20/LA 3132 to I-20 (East)	Controlled-access	119	18			
	-	I-49	I-20 to 0.5 mile south of LA 526 interchange	Controlled-access	41	8			
	-	LA 3132	I-20/I-220 to LA 526	Controlled-access	43	10			
	-	I-20	I-220/LA 3132 to I-220 (East)	Controlled-access	85	15			
	-	I-20	I-220/LA 3132 to LA 526	Controlled-access	19	3			
	-	I-20	LA 526 to 0.5 mile west of LA 169 interchange	Controlled-access	40	11			
	-	I-20	I-220 (East) to 0.5 mile east of LA 157 interchange	Controlled-access	56	15			
TOTAL (3)					579	220	15	395	10

(1) Signal system improvements for the timeframe/phase are upgrades of existing equipment (e.g. controllers, detectors, and interconnect) versus complete signal system replacement.

(2) Signal system improvements for this timeframe/phase are replacement of remaining equipment not upgraded previously.


(3) To avoid double-counting, intersection signals improved in separate timeframe/phases (see Notes 1 & 2) are reflected only once in the “Total”.

Note: Transit deployment not included (see *Table 3.16*).



- LEGEND
- INTERSTATE ROUTE
 - UNITED STATES ROUTE
 - STATE ROUTE
 - PARISH ROUTE
 - IMMEDIATE-TERM PRIORITY
 - NEAR-TERM PRIORITY
 - MID-TERM PRIORITY (SEE NOTE 3)
 - SIGNALIZED INTERSECTION
 - DMS DYNAMIC MESSAGE SIGN

- NOTES:
- INTERIM TMC COMPONENTS TO BE LOCATED AT EXISTING DOTD DISTRICT 04 OFFICE (3339 INDUSTRIAL DR., BOSSIER CITY) AND EXISTING CITY OF SHREVEPORT TRAFFIC ENGINEERING OFFICE (2123 LAKESHORE DR., SHREVEPORT).
 - REGIONAL TMC TO BE LOCATED AT SITE OF EXISTING DOTD DISTRICT 04 OFFICE.
 - MID-TERM PRIORITY INCLUDES ALL REMAINING TRAFFIC SIGNALS IN SHREVEPORT (APPROX. 79).
 - A TOTAL OF THREE DYNAMIC MESSAGE SIGNS ARE PLANNED BY OTHERS (REDUCED VISIBILITY ENHANCEMENT PHASE 2 S.P. No. 737-99-0467) AS NOTED.



Shreveport/Bossier City Regional ITS Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253




Figure 3.11
Fiscally-Constrained ITS Deployment
(Immediate/Near/Mid-Term Program)



PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.
URS Project No. 04-00046316.02 | DATE: MAY 2002

**Table 3.13a Summary of Fiscally-Constrained ITS Deployment
(Immediate/Near/Mid-Term Program)**

Timeframe	Phase	Description	Construction Cost ⁽¹⁾	Design Cost ⁽²⁾
All	All	primary (trunkline) communications	\$8,244,000	\$824,400
		secondary (distribution) communications		
		SUBTOTAL	\$8,244,000	\$824,400
Immediate	1	11 CCTV cameras signal system improvements at 27 intersections	\$951,600	\$95,160
	2	signal system improvements at 26 intersections	\$3,120,000	\$312,000
	3	signal system improvements at 22 intersections	\$2,640,000	\$264,000
		SUBTOTAL	\$6,711,600	\$671,160
Near	1	DOTD Interim TMC Shreveport Interim TMC DOTD Interim TMC Software & Integration Shreveport Interim TMC Software & Integration 76 radar vehicle detectors 25 CCTV cameras 5 dynamic message signs 4 highway advisory radio stations	\$4,686,000	\$468,600
	2A	RTMC	\$3,600,000	\$360,000
	2B	RTMC Software & Integration	\$2,400,000	\$240,000
	3	88 radar vehicle detectors 32 CCTV cameras 5 dynamic message signs	\$3,895,200	\$389,520
	4	signal system improvements at 21 intersections	\$2,520,000	\$252,000
	5	10 CCTV cameras signal system improvements at 76 intersections	\$9,396,000	\$939,600
	6	signal system improvements at 17 intersections	\$2,040,000	\$204,000
	7	8 CCTV cameras 3 dynamic message signs	\$760,800	\$76,080
		SUBTOTAL	\$29,298,000	\$2,929,800
Mid	1	12 radar vehicle detectors 15 CCTV cameras 2 dynamic message signs	\$1,062,000	\$106,200
	2	signal system improvements at 38 intersections	\$912,000	\$91,200
	3	signal system improvements at 18 intersections	\$432,000	\$43,200
	4	signal system improvements at 30 intersections	\$720,000	\$72,000
	5	signal system improvements at 27 intersections	\$648,000	\$64,800
	6	signal system improvements at 14 intersections	\$336,000	\$33,600
	7	signal system improvements at 79 intersections	\$1,896,000	\$189,600
		SUBTOTAL	\$6,006,000	\$600,600
TOTAL			\$50,259,600	\$5,025,960

(1) Purchase and installation cost. Includes 20% contingency. Year 2002 dollars.

(2) 10% of "Construction" cost. Year 2002 dollars.

Note: Transit deployment not included (see *Table 3.16*).

**Table 3.13b Summary of Fiscally-Constrained ITS Deployment
(Long-Term Program)**

Timeframe	Phase	Description	Construction Cost ⁽¹⁾	Design Cost ⁽²⁾
Long	-	403 radar vehicle detectors 119 CCTV cameras additional upgrades to Shreveport signal system at 206 intersections 10 weather stations (includes one CCTV camera per station) Regional Maintenance Facility	\$35,024,400	\$3,502,440
TOTAL			\$35,024,400	\$3,502,440

(1) Purchase and installation cost. Includes 20% contingency. Year 2002 dollars.

(2) 10% of "Construction" cost. Year 2002 dollars.

Note: Transit deployment not included (see **Table 3.16**).

Table 3.14 Fiscally-Constrained Proposed Primary ITS Deployment Costs and Schedule

Timeframe	Phase	Description	Cost Component	TOTAL	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All	All	Primary (trunkline) communications Secondary (distribution) communications	Design ^(2, 3)	\$824	\$46	\$92	\$92	\$92	\$92	\$92	\$92	\$92	\$92	\$46	\$0
			Construction ^(1, 3)	\$8,244	\$0	\$458	\$916	\$916	\$916	\$916	\$916	\$916	\$916	\$916	\$458
			SUBTOTAL	\$9,068	\$46	\$550	\$1,008	\$1,008	\$1,008	\$1,008	\$1,008	\$1,008	\$1,008	\$962	\$458
Immediate	1	11 CCTV cameras Signal system improvements at 27 intersections	Design ^(2, 4)	\$95	\$48	\$48	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			Construction ⁽¹⁾	\$952	\$0	\$317	\$634	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$1,047	\$48	\$365	\$634	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	2	Signal system improvements at 26 intersections	Design ⁽²⁾	\$312	\$156	\$156	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			Construction ⁽¹⁾	\$3,120	\$0	\$1,248	\$1,872	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$3,432	\$156	\$1,404	\$1,872	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	3	Signal system improvements at 22 intersections	Design ⁽²⁾	\$264	\$0	\$264	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			Construction ⁽¹⁾	\$2,640	\$0	\$0	\$2,112	\$528	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$2,904	\$0	\$264	\$2,112	\$528	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Near	1	DOTD Interim TMC & Shreveport Interim TMC DOTD Interim TMC Software & Integration Shreveport Interim TMC Software & Integration 76 radar vehicle detectors, 25 CCTV cameras 5 dynamic message signs, 4 highway advisory radio stations	Design ^(2, 3)	\$469	\$0	\$176	\$234	\$59	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			Construction ^(1, 3)	\$4,686	\$0	\$0	\$1,562	\$2,083	\$1,041	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$5,155	\$0	\$176	\$1,796	\$2,141	\$1,041	\$0	\$0	\$0	\$0	\$0	\$0
	2A	RTMC	Design ⁽²⁾	\$360	\$0	\$180	\$180	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			Construction ⁽¹⁾	\$3,600	\$0	\$0	\$514	\$2,057	\$1,029	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$3,960	\$0	\$180	\$694	\$2,057	\$1,029	\$0	\$0	\$0	\$0	\$0	\$0
	2B	RTMC Software & Integration	Design ⁽²⁾	\$240	\$0	\$0	\$0	\$240	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			Construction ⁽¹⁾	\$2,400	\$0	\$0	\$0	\$0	\$2,400	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$2,640	\$0	\$0	\$0	\$240	\$2,400	\$0	\$0	\$0	\$0	\$0	\$0
	3	88 radar vehicle detectors 32 CCTV cameras 5 dynamic message signs	Design ^(2, 3)	\$390	\$0	\$0	\$0	\$111	\$223	\$56	\$0	\$0	\$0	\$0	\$0
			Construction ^(1, 3)	\$3,895	\$0	\$0	\$0	\$0	\$556	\$2,226	\$1,113	\$0	\$0	\$0	\$0
			SUBTOTAL	\$4,285	\$0	\$0	\$0	\$111	\$779	\$2,281	\$1,113	\$0	\$0	\$0	\$0
	4	Signal system improvements at 21 intersections	Design ⁽²⁾	\$252	\$0	\$0	\$0	\$0	\$0	\$189	\$63	\$0	\$0	\$0	\$0
			Construction ⁽¹⁾	\$2,520	\$0	\$0	\$0	\$0	\$0	\$0	\$1,512	\$1,008	\$0	\$0	\$0
			SUBTOTAL	\$2,772	\$0	\$0	\$0	\$0	\$0	\$189	\$1,575	\$1,008	\$0	\$0	\$0
	5	10 CCTV cameras Signal system improvements at 76 intersections	Design ^(2, 3)	\$940	\$0	\$0	\$0	\$0	\$0	\$418	\$418	\$104	\$0	\$0	\$0
			Construction ^(1, 3)	\$9,396	\$0	\$0	\$0	\$0	\$0	\$0	\$2,088	\$4,176	\$3,132	\$0	\$0
			SUBTOTAL	\$10,336	\$0	\$0	\$0	\$0	\$0	\$418	\$2,506	\$4,280	\$3,132	\$0	\$0
	6	Signal system improvements at 17 intersections	Design ⁽²⁾	\$204	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$153	\$51	\$0	\$0
			Construction ⁽¹⁾	\$2,040	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$1,530	\$510	\$0
			SUBTOTAL	\$2,244	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$153	\$1,581	\$510	\$0

Table 3.14 Fiscally-Constrained Proposed Primary ITS Deployment Costs and Schedule

Timeframe	Phase	Description	Cost Component	TOTAL	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Near	7	8 CCTV cameras 3 dynamic message signs	Design ⁽²⁾	\$76	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$76	\$0	\$0	
			Construction ⁽¹⁾	\$761	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$761	\$0
					\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$837	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$76	\$761	\$0
Mid	1	12 radar vehicle detectors 15 CCTV cameras 2 dynamic message signs	Design ⁽²⁾	\$106	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$106	\$0	
			Construction ⁽¹⁾	\$1,062	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$1,062	
					\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
			SUBTOTAL	\$1,168	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$106	\$1,062	
	2 - 7	Additional upgrades to Shreveport signal system at 206 intersections	Design ^(2,3)	\$494	\$0	\$0	\$0	\$0	\$0	\$82	\$110	\$110	\$110	\$82	\$0	
			Construction ^(1,3)	\$4,944	\$0	\$0	\$0	\$0	\$0	\$0	\$781	\$1,041	\$1,041	\$1,041	\$1,041	
					\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
			SUBTOTAL	\$5,438	\$0	\$0	\$0	\$0	\$0	\$82	\$890	\$1,151	\$1,151	\$1,123	\$1,041	
DEPLOYMENT COST TOTALS				Design ⁽²⁾	\$5,026	\$249	\$915	\$506	\$501	\$314	\$836	\$682	\$459	\$329	\$234	\$0
				Construction ⁽¹⁾	\$50,260	\$0	\$2,023	\$7,611	\$5,584	\$5,942	\$3,142	\$6,410	\$7,141	\$6,619	\$3,228	\$2,561
				TOTAL	\$55,286	\$249	\$2,938	\$8,117	\$6,085	\$6,257	\$3,978	\$7,092	\$7,600	\$6,947	\$3,462	\$2,561

(1) Purchase and installation cost. Includes 20% contingency. Year 2002 dollars. Costs in thousands. Construction timeline starts upon receipt of 100% Final PS&E. Includes: 5 months (100% Final Plans to advertisement) + 1 month (to letting/award) + 2 months (assembly period) = 8 months + "actual construction" (NTP to completion).

(2) 10% of "Construction" cost. Year 2002 dollars. Costs in thousands. Design timeline includes design and submittal of 100% Final PS&E only. Includes: 4 months (30% / 60% / 90% / 95% DOTD reviews) + 2 months (address comments) = 6 months + "actual design" (NTP to 100% Final PS&E submittal).

(3) Design and construction timelines overlap due to assumed overlapping of multiple design/construction phases within the project.

(4) The timeline reflects an accelerated schedule to ensure timely deployment.

NOTE: Quarterly outlays are assumed for annual Design and Construction cost estimates.

Table 3.15 Summary of Fiscally-Constrained Proposed Primary ITS Deployment Funding

Project Description ⁽¹⁾	Project Components	Preliminary Cost Estimate ⁽⁴⁾	Projected Let Date	Anticipated Funding Source	Comments
Immediate-Term Phase 1 Deployment Surface street CCTV Camera system and/or signal system improvements along LA 511, LA 3132, LA 1, McDade Street, and LA 3.	11 CCTV cameras Signal system improvements at 27 intersections	⁽²⁾ Design = \$156,972 ⁽³⁾ <u>Construction</u> = <u>\$1,569,720</u> TOTAL = \$1,726,692	December 2003	Earmark No. 1	The construction cost reflects an 80% reduction in signal system improvements cost to account for interconnect and other hardware, currently being installed by DOTD, using non-ITS funds. Includes 8% of trunkline and 7% of distribution communications costs.
Immediate-Term Phase 2 Deployment Surface street signal system improvements along LA 526, US 171, and Jewella Road.	Signal system improvements at 26 intersections	⁽²⁾ Design = \$340,980 ⁽³⁾ <u>Construction</u> = <u>\$3,409,800</u> TOTAL = \$3,750,780	December 2003	Earmark No. 1 Earmark No. 2 Shreveport Local Funds	Includes 7% of distribution communications costs.
Immediate-Term Phase 3 Deployment Surface street signal system improvements along LA 1, LA 511, and US 171.	Signal system improvements at 22 intersections	⁽²⁾ Design = \$288,840 ⁽³⁾ <u>Construction</u> = <u>\$2,888,400</u> TOTAL = \$3,177,240	June 2004	Earmark No. 3 Shreveport Local Funds	Includes 6% of distribution communications costs.
Near-Term Phase 1 Deployment Controlled-access CCTV Camera and DMS systems along I-20. RVD and/or CCTV Camera systems at I-20/I-220/LA 3132, I-20/I-49, I-20/LA 1, I-20/LA 3105 and I-20/I-220 (East) interchanges and controlled-access approaches. HAR system including four stations (sites to be determined). DOTD and Shreveport Interim TMCs and required network management and systems software/integration.	DOTD Interim TMC Shreveport Interim TMC DOTD Interim TMC Software & Integration Shreveport Interim TMC Software & Integration 76 radar vehicle detectors, 25 CCTV cameras 5 dynamic message signs, 4 highway advisory radio stations	⁽²⁾ Design = \$468,600 ⁽³⁾ <u>Construction</u> = <u>\$4,686,000</u> TOTAL = \$5,154,600	September 2004 (see Note 5)	State ITS Funds Federal Earmark	None
Near-Term Phase 2A Deployment RTMC construction and equipment purchase and installation.	RTMC	⁽²⁾ Design = \$360,000 ⁽³⁾ <u>Construction</u> = <u>\$3,600,000</u> TOTAL = \$3,960,000	March 2005	Federal Earmark State ITS Funds	None
Near-Term Phase 2B Deployment Required RTMC traffic management and systems software/integration.	RTMC Software & Integration	⁽²⁾ Design = \$240,000 ⁽³⁾ <u>Construction</u> = <u>\$2,400,000</u> TOTAL = \$2,640,000	June 2006	Federal Earmark Integration Grant	None

Table 3.15 Summary of Fiscally-Constrained Proposed Primary ITS Deployment Funding

Project Description ⁽¹⁾	Project Components	Preliminary Cost Estimate ⁽⁴⁾	Projected Let Date	Anticipated Funding Source	Comments
Near-Term Phase 3 Deployment RVD and/or CCTV Camera systems at LA 3132/Linwood Avenue, LA 3132/LA 523, LA 3132/LA 526, I-220/US 71/LA 1, I-220/LA 3105, I-49/LA 526 and I-49/LA 3132 interchanges and controlled-access approaches. Controlled-access CCTV Camera and DMS systems along I-220.	88 radar vehicle detectors 32 CCTV cameras 5 dynamic message signs	⁽²⁾ Design = \$520,848 ⁽³⁾ Construction = <u>\$5,208,480</u> TOTAL = \$5,729,328	March 2007 (see Note 5)	Integration Grant State ITS Funds	Includes 32% of trunkline communications costs.
Near-Term Phase 4 Deployment Surface street signal system improvements on US 71/LA 1.	Signal system improvements at 21 intersections	⁽²⁾ Design = \$272,700 ⁽³⁾ Construction = <u>\$2,727,000</u> TOTAL = \$2,999,700	September 2008	To be determined	Includes 5% of distribution communications costs.
Near-Term Phase 5 Deployment Surface street CCTV Camera system and/or signal system improvements on Kings Highway, LA 3032, LA 511, US 79/80, Murphy Street, LA 3, US 71, LA 3105, Shed Road, and Swan Lake Road.	10 CCTV cameras Signal system improvements at 76 intersections	⁽²⁾ Design = \$1,153,692 ⁽³⁾ Construction = <u>\$11,536,920</u> TOTAL = \$12,690,612	December 2008 (see Note 5)	To be determined	Includes 33% of trunkline and 19% of distribution communications costs.
Near-Term Phase 6 Deployment Surface street signal system improvements on LA 3094 and US 171.	Signal system improvements at 17 intersections	⁽²⁾ Design = \$220,560 ⁽³⁾ Construction = <u>\$2,205,600</u> TOTAL = \$2,426,160	September 2010	To be determined	Includes 4% of distribution communications costs.
Near-Term Phase 7 Deployment Controlled-access CCTV Camera and DMS systems on I-49.	8 CCTV cameras 3 dynamic message signs	⁽²⁾ Design = \$76,080 ⁽³⁾ Construction = <u>\$760,800</u> TOTAL = \$836,880	June 2011	To be determined	None
Mid-Term Phase 1 Deployment Controlled-access CCTV Camera and/or DMS systems on LA 3132 and I-20. RVD and/or CCTV Camera systems at I-20/LA526 interchange and controlled-access approaches.	12 radar vehicle detectors 15 CCTV cameras 2 dynamic message signs	⁽²⁾ Design = \$217,008 ⁽³⁾ Construction = <u>\$2,170,080</u> TOTAL = \$2,387,088	June 2012	To be determined	Includes 27% of trunkline communications costs.
Mid-Term Phases 2 – 7 Deployment Surface street signal system improvements on LA 511, Pines Road, Jewella Road, Line Avenue, LA 526, LA 173, Allen Avenue, Linwood Avenue, US 79/80, Hollywood Avenue, Pierremont Road, Southfield Road, Murphy Street/Stoner Avenue, Lakeshore Drive/Yarbrough Road, the Shreveport CBD, and all other remaining Shreveport signals.	Signal system improvements at 206 intersections	⁽²⁾ Design = \$709,680 ⁽³⁾ Construction = <u>\$7,096,800</u> TOTAL = \$7,806,480	September 2008 (see Note 5)	To be determined	Includes 52% of distribution communications costs. Improvements are upgrades of existing equipment (e.g. controllers, detectors, and interconnect) versus complete system replacement.
DEPLOYMENT COST TOTALS		⁽²⁾ Design = \$5,025,960 ⁽³⁾ Construction = <u>\$50,259,600</u> TOTAL = \$55,285,560			

(1) See *Table 3.12* for detailed project limits.
(2) 10% of "Construction" cost. Year 2002 dollars.
(3) Purchase and installation cost. Includes 20% contingency. Year 2002 dollars.
(4) For funding calculation purposes, Trunkline and Distribution Communications costs are assigned to deployment timeframes/phases as noted.
(5) Let Date for initial construction phase. Multiple design/construction phases within the overall project are assumed.
Note: Transit deployment not included (see *Table 3.16*).

Table 3.16 Summary of Proposed Transit ITS Deployment (Unconstrained)

Phase & Investment		Estimated Implementation Cost	Comments
Near-Term			
N-1:	Preliminary Design & Communications System Study	\$50,000	Study to detail overall ITS transit needs and analyze communications issues.
N-2:	Radio System Upgrade (partial)	\$400,000	Preliminary estimate for dispatch center equipment only; communications system study required to further identify cost.
N-3:	CAD/AVL System with APCs and Enunciators	\$1,750,000	AVL for all vehicles, including additional radio system upgrade, supervisory and maintenance. APCs for approximately 4 fixed-route vehicles; enunciators for all fixed-route vehicles.
Near-Term Subtotal		\$2,200,000	
Mid-Term			
M-1:	Demand-Responsive Passenger Information/Fare System	\$250,000	Cost includes specification development.
M-2:	Initial Real-Time Bus Status Information System and Transfer Coordination	\$200,000	Can be bundled with N-3, which will provide the design and integration. This cost is for hardware (signs) and installation.
M-3:	Automated Trip Planning System	\$300,000	Includes cost for software.
M-4:	Expanded Real-Time Bus Status Information System	\$200,000	Additional signs/monitors.
M-5:	Enhanced Demand-Responsive Service Coordination	\$250,000	Utilize systems implemented in N-3. This cost supports any required communications or software additions.
Mid-Term Subtotal		\$1,200,000	
Long-Term			
L-1:	On-Board and Station Security Recording	\$300,000	Selected routes/vehicles and key stops/centers.
L-2:	Enhanced Vehicle Monitoring	\$350,000	Cost dependent on specific approach.
L-3:	Real-Time On-Board Security Monitoring	\$500,000	None.
Long-Term Subtotal		\$1,150,000	None.
Program Total		\$4,550,000	

(1) Contingency not included. Year 2002 dollars.

4.0 HIGH-LEVEL ITS COMMUNICATIONS DESIGN CONCEPT

A high-level design concept has been developed for a communications system to support ITS deployment in the Shreveport/Bossier City region. This section summarizes that design concept (see *Appendix E* for details). The concept is intended to establish the overall direction for the regional ITS communications system and to support the development of conceptual cost estimates for planned ITS projects. The concept does not identify specific approaches to be utilized in specific locations or projects; those details will be identified during design. Rather, this concept identifies an overall approach and defines the range of options from which site and project specific approaches will be selected during subsequent design efforts.

4.1 Overall Design Principles

The ITS communications design for the Shreveport/Bossier City region should be guided by the following general principles:

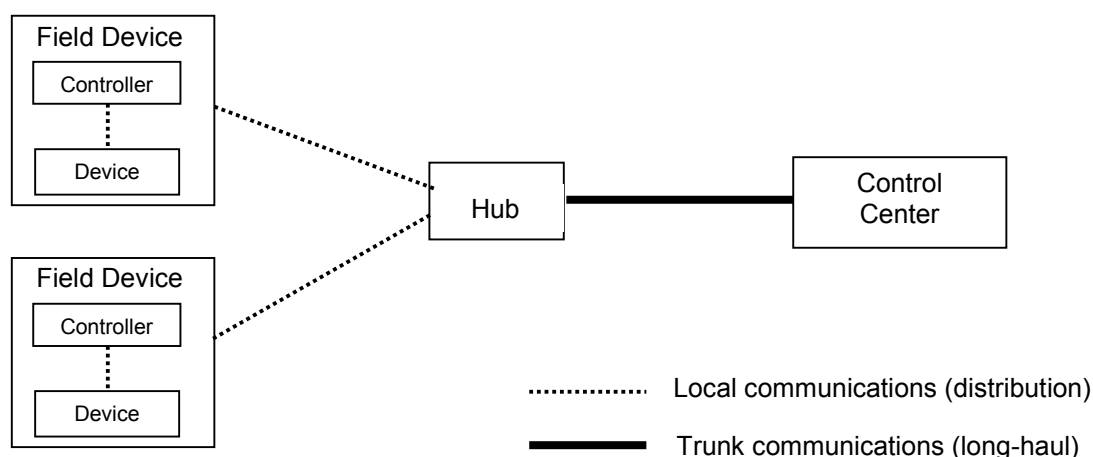
- To the extent possible, *maximize the use of existing stakeholder communications investments*, including existing copper/twisted-pair cable, fiber optic cable, and microwave systems and *accommodate existing, or “legacy”, ITS components*.
- To the extent possible, in light of unique local opportunities and constraints, maintain *consistency and compatibility with emerging stakeholder ITS communications approaches* established through ITS deployments elsewhere in the state.
- *Consolidate and centralize processing functions* at the TMC so as to reduce potential failure points, reduce costs, and provide for efficient central system management and maintenance.
- Utilizing an *“open” architecture*, provide for the maximum level of flexibility and connectivity.
- Utilize *proven technologies and techniques*.
- Insure system *security*.

4.2 Basic ITS Communications Infrastructure Terms and Concepts

Figure 4.1 schematically depicts the basic components of roadway-based (as opposed to transit or other mobile applications) ITS communication system and their relationships. The components are described below.

The basic components of an ITS communications system include the following elements:

Figure 4.1
ITS Communications Systems
Components and Relationships



Field devices – individual ITS devices typically located on or near roadways, such as closed-circuit television (CCTV) cameras, vehicle detectors, changeable message signs or traffic signals. In addition to the devices themselves, field device systems include power sources and controllers. Controllers are specialized computers, mounted in cabinets, that are dedicated to the operation of various ITS devices. When various field devices are located close together, and depending on their functions, multiple devices may be controlled through a single controller.

Communications Hubs – points, or nodes, in the communications system where the local communications to various nearby field devices are consolidated, before being routed to one or more control centers.

Control Center(s) – one or more locations from which ITS systems are operated, for example, a traffic management center. Typically, an agency will operate its ITS system from a single central control center.

Local Communications – also known as the “distribution” component of the communications system. Local communications describes the communications infrastructure that connects field devices to their controllers, and that connects field device systems to communications hubs. Common media used for local ITS communications includes copper wire, fiber optic cable, and wireless (e.g., microwave or radio). Typically, although not always, local communications are owned by the agency that owns the ITS field devices, as opposed to being leased from commercial providers, such as local telephone companies or commercial radio system operators.

Trunk Communications – also known as the “long-haul” component of the communications system. Trunk communications link communications hubs with ITS control centers. The most common media for ITS trunk communications is fiber optic cable, primarily because of its high capacity and ability to support extensive CCTV surveillance. However, other media, including

microwave and other wireless communications, are also used, and can support CCTV surveillance.

4.3 Summary

The Shreveport/Bossier City high-level ITS communications design concept is a long-term concept, designed to support the full build-out of the regional ITS system. An analysis of the communications capacity, or “bandwidth”, required to support the proposed deployment presented in **Section 3.0** was conducted, based on estimates of the size of the information packages to be communicated to and from various ITS components, and the frequency of those communications. Alternative communications media and protocols capable of providing the required bandwidth were then assessed, considering cost, flexibility and reliability.

Figure 4.2 schematically illustrates the high-level regional ITS communications design concept for the Shreveport/Bossier City region. The concept utilizes a combination of communications technologies, which will vary by location depending on site-specific factors, and takes advantage of both existing fiber optic cable and wireless transport and technology. **Table 4.1** summarizes the approaches for both trunk and local communications.

Table 4.1 High-Level ITS Design Concept Summary

Communications Component	Strategy
Trunk Communications	Dual-ring (redundant) fiber optic cable using the SONET standard, and a combination of IP (Internet Protocol) and ATM (Asynchronous Transfer Mode).
Local Communications: Devices to Controllers:	Various media, depending on site-specific criteria, including availability of existing copper/twisted-pair, fiber and potential for radio interference: <ul style="list-style-type: none"> ▪ Fiber optic cable (using SONET standard, IP routing and ATM switching) ▪ Leased lines (telephone, T-1, etc.) ▪ Spread-spectrum radio (using wireless Ethernet standards)
Controllers to Hubs:	Various media, depending on site-specific criteria, including availability of existing fiber, availability of existing microwave, and potential for radio interference: <ul style="list-style-type: none"> ▪ Fiber optic cable (using SONET standard, IP routing and ATM switching) ▪ Spread-spectrum radio (using wireless Ethernet standards) ▪ Leased lines (telephone, T-1, etc.) ▪ Microwave w/fiber optic cable (using wireless Ethernet standards)
Communications Hubs	ATM add/drop multiplex switches

Trunk (core network) communications will utilize fiber optic cable, using the SONET (Synchronous Optical NETwork) standard developed by the American National Standards Institute, the same standard being used by DOTD in other fiber optic ITS communications systems. **Figures 4.3** and **4.4** illustrate potential trunk fiber routes. The trunk fiber will also support Internet Protocol (IP) routing and Asynchronous Transfer Mode (ATM) switching. SONET, IP and ATM each have their unique advantages and a trunk network supporting all three approaches will provide maximum flexibility. Fiber optic cable is a very reliable, very

high capacity communications medium that can accommodate many types of data over a single link.

Local communications will use a combination of communications media, depending on site-specific characteristics, including: the availability of existing fiber optic cable; potential for radio interference; and accessibility (e.g., elevated structures, remote locations, availability of right-of-way). Communications between individual ITS field devices and their controller cabinets will utilize either fiber optic cable, leased communications lines (e.g., T-1, ISDN, etc.), or spread-spectrum radio. Communications between field device controllers and communications hubs will utilize either fiber optic cable, leased communications lines (e.g., T-1, ISDN, etc.), spread-spectrum radio or microwave. As with the trunk communications links, local communications will support IP, Ethernet and ATM.

The selection of the specific communications media to be used for particular projects in particular locations will be made during design. The analysis of wireless communications options should include both a terrain analysis and a frequency analysis. A terrain analysis is needed to determine whether the surrounding environment, including topography, buildings, etc. will physically interfere with wireless signals. A frequency analysis is needed to determine whether signals from other wireless communications systems will create interference, a possibility since wireless Ethernet typically uses an unregulated frequency spectrum.

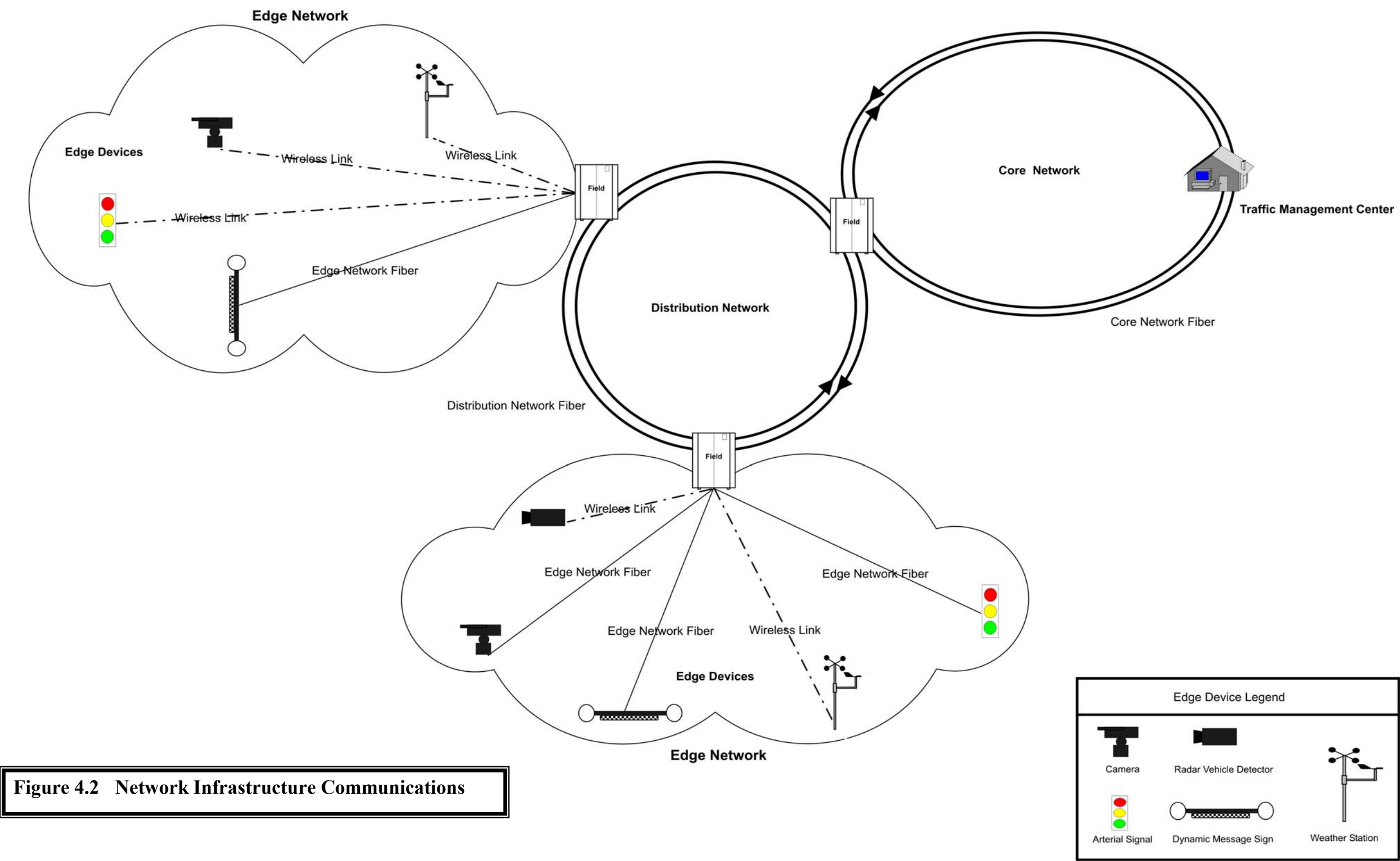
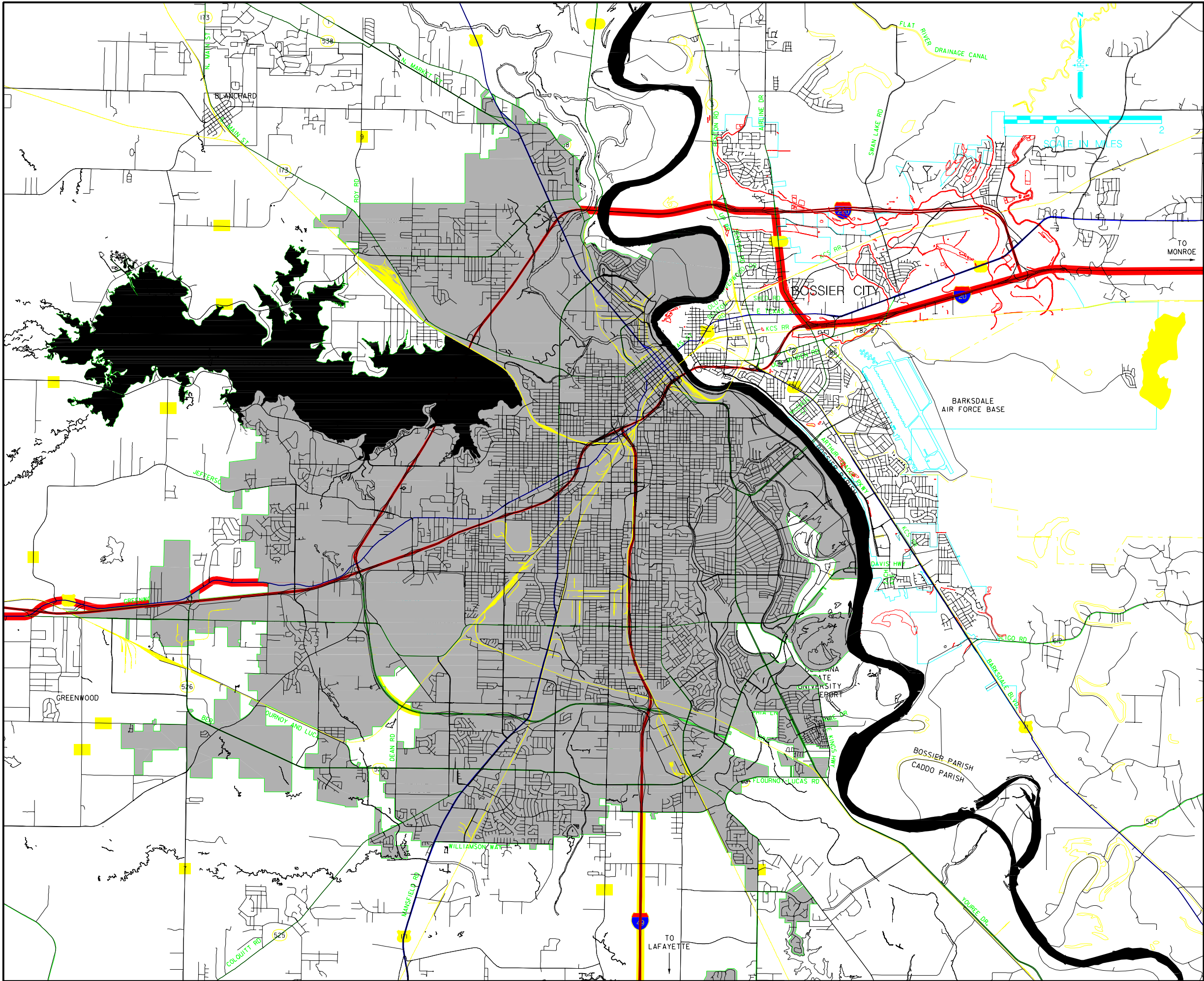


Figure 4.2 Network Infrastructure Communications



LEGEND

- INTERSTATE ROUTE
- UNITED STATES ROUTE
- STATE ROUTE
- PARISH ROUTE
- EXISTING McCLEOD RESOURCE SHARE FIBER
- POTENTIAL PRIMELINK RESOURCE SHARE FIBER

INFORMATION SOURCE:
CSC CONSULTING GROUP

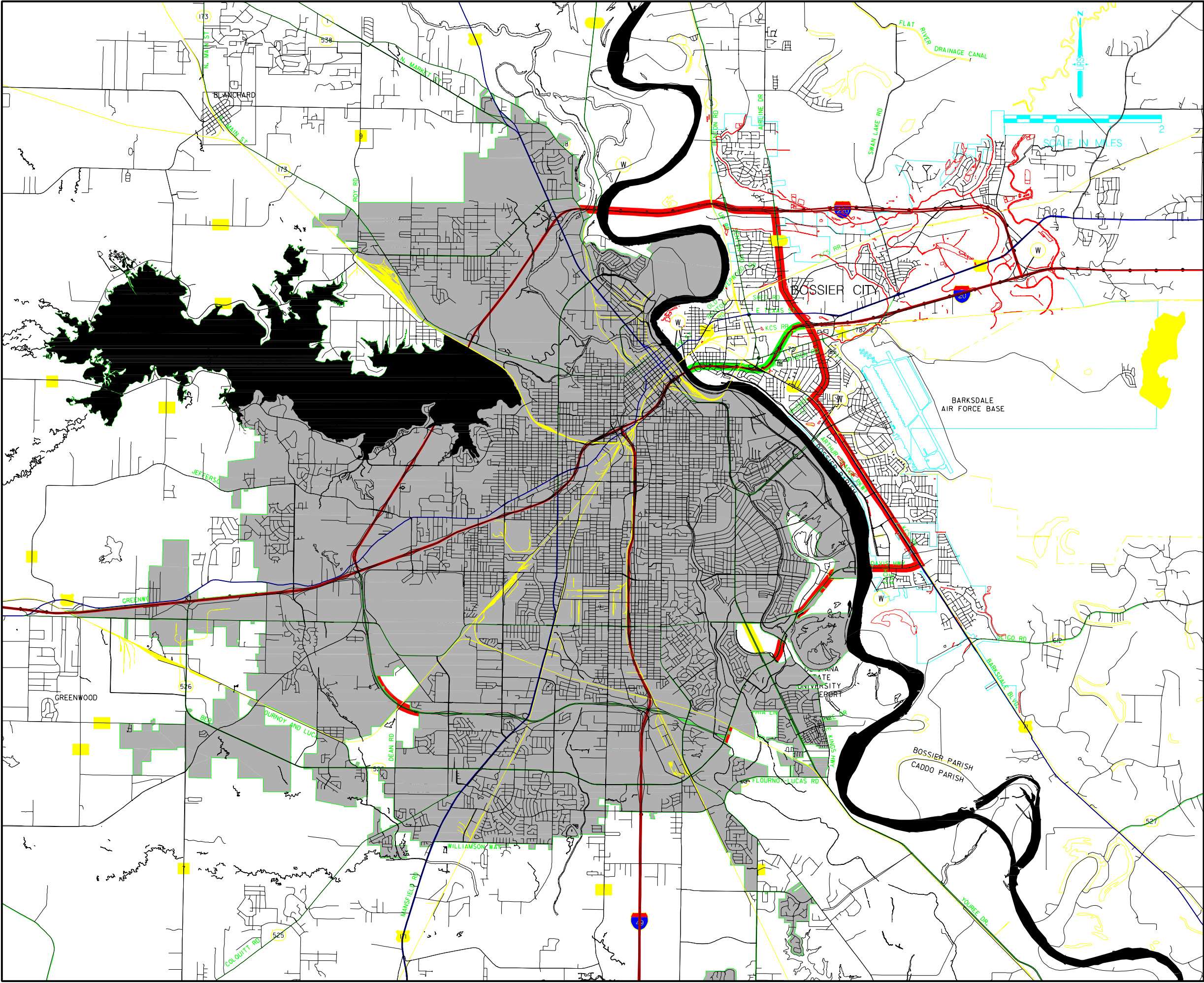
Shreveport/Bossier City Regional ITS
Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253

Figure 4.3
Potential State ITS Trunk Fiber

PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.

URS Project No. 04-00046316.02

DATE: MAY 2002



LEGEND

	INTERSTATE ROUTE
	UNITED STATES ROUTE
	STATE ROUTE
	PARISH ROUTE
	PROPOSED LOCAL ITS TRUNK FIBER
	POTENTIAL ALTERNATIVE LOCAL ITS TRUNK FIBER ROUTE
	POTENTIAL ALTERNATIVE LOCAL ITS TRUNK FIBER ROUTE (ALTERNATIVE TO I-49)
	PROPOSED CCTV CAMERA
	PROPOSED REGIONAL TMC
	PROPOSED WEATHER STATION

NOTE:

1. THERE ARE ADDITIONAL CCTV CAMERAS PROPOSED AT SELECTED MAJOR INTERCHANGES THAT ARE NOT SHOWN (FOR CLARITY).

Shreveport/Bossier City Regional ITS Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253

PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.

Figure 4.4
Proposed CCTV Cameras & Local ITS Trunk Fiber

URS
PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.

URS Project No. 04-00046316.02 | DATE: MAY 2002

5.0 DEPLOYMENT PLAN COMPONENTS

The following documents the Preliminary Implementation Plan component of the *Strategic Deployment Plan* and was developed consistent with the “*Implementation Plan*” requirements documented in 23 CFR 655.409(f). The purpose is to address key issues and document strategies, methods and agreements which will be utilized to implement and operate the planned ITS Deployment as defined in the previous sections, including other current associated planned ITS improvements within the region addressing system design issues, procurement methods, institutional arrangements, and personnel and budget resources.

5.1 Deployment Approach

During the project design phase, as the full implications of using specific hardware/software systems come more into focus, it may be necessary to rethink some of the decisions reflected in prior planning. It is fully appropriate, in fact, it should be viewed as a responsibility, to make trade-offs and appropriate changes in the project at that point in the project development process.

There are two general approaches typically taken in deploying advanced transportation management systems, the full deployment approach and the staged project approach. Under the full deployment approach the entire Advanced Traffic Management System (ATMS) is deployed under one construction contract.

The “Staged” project approach entails an incremental deployment, in which separate contracts are awarded for the construction of a number of stand-alone subsystems, which when completed, will comprise the comprehensive ATMS.

The “Full Deployment” approach requires higher levels of annual funding, which are often difficult to secure, and the operating staff must be capable of immediately operating the entire system all at once with no time for staff to grow into that level of operation through operating smaller, less complex subsystems.

Due to limited financial resources and the limited ITS operations expertise, the “Staged” implementation process will be utilized for ITS deployment in the Shreveport/Bossier City metropolitan region consistent with the ITS Strategic Plan.

The “Staged” or “Incremental” approach includes construction of a series of projects, each consisting of a stand-alone subsystem capable of delivering benefits, under separate contracts over a period of time. Each subsequent subsystem is integrated with those that have preceded it, evolving into a comprehensive ATMS. Under this approach, available funding level concerns are minimized as projects are implemented over a period of time consistent with available funding levels. There is also the opportunity to select the most visible and beneficial projects of which there is a high probability of early success. Systems also come on-line at a more manageable pace.

The advantages associated with this “Staged” or “Incremental” approach include the following:

- Ability to implement the program in phases consistent with funding levels.
- Allows staff skills and operational procedures to evolve over time, beginning with minimized complexity and evolving into a more sophisticated operational system.
- This concept also allows for the building of inter-agency working relationships concurrent with the evolution of the system.
- Concepts of ITS freeway and incident management are allowed to grow and mature as the overall system evolves.
- Traffic management measures are introduced to the public in smaller, perhaps more acceptable, increments.
- As the initial system evolves, realistic accounts of maintenance requirements, reliability of system equipment, and system Operations and Maintenance (O&M) costs are determined, allowing for better evaluations of future deployment.

5.2 System Designer

Due to the complexity of the system and in-house expertise constraints, Consultant Services have been procured. The System Manager approach was utilized and the Consultant Team consists of PB Farradyne, GEC, URS, and CSC. Items, generally included in the scope of work for the System Manager, are as follows:

- Development of plans and specifications for field deployment of equipment including:
 - CCTV cameras and associated structures.
 - Volume/Speed/Occupancy (VSO) detectors.
 - Dynamic message signs and associated structures.
 - Ramp meters.
 - Lane control signals.
 - Highway Advisory Radio (HAR) stations.
 - Cabinets and controllers.
 - Power distribution systems.
 - Required communications equipment and distribution system.

- System Integration – The System Manager may be responsible for system integration including specification of hardware and associated firmware at the Regional Traffic Management Center (RTMC), for operation of equipment deployment in the field, as well as development of project specific software as required for system integration.
- Development of operational guidelines in cooperation with the Advisory Committee, (See **Section 6.0**) and to provide training for systems operation to RTMC staff.

5.3 System Design Life

The ITS Strategic Plan proposes implementation of the Shreveport/Bossier City regional ITS system over a 10 to 15 year horizon, with the majority of the ITS infrastructure being implemented in the initial 10 year period depending on the availability and programming of financial resources. While the functional operating life of the proposed ITS System for deployment may exceed 30 years, a 30-year time frame was utilized as a reasonable estimate of the functional operating life of the system.

5.4 System Coverage

The system coverage identified in the Shreveport/Bossier City Regional ITS Strategic Plan incorporated two main transportation networks, the interstate system and primary arterial streets. The ITS freeway and incident management system is primarily geared toward the interstate network/controlled access arterials. Advanced surface street control is typically associated with the arterial street system. The system coverage defined in the ITS Strategic Plan over the 10+ year horizon, includes approximately 70 miles of expressway and 160 miles of arterial routes (not including 79 signals at various locations) as previously illustrated in **Figure 3.1**. Full (i.e. unconstrained) field device equipment projections currently envisioned:

- 220 CCTV cameras.
- 15 Dynamic message signs (not including 3 by others)
- 579 Radar vehicle detectors.
- Signal system improvements at 395 intersections.
- 10 Weather stations.
- 4 Highway Advisory Radio stations.

The system design life designated in *Section 5.3* is 30 years, with the system design life extending through the year 2031. While the Strategic Deployment Plan addresses a 10 to 15 year deployment plan, there is the potential for system expansion beyond the 15-year horizon over the next 30 years. Any further expansion of the Advanced Surface Street Control System would be consistent with the Congestion Management Systems planning process and future incident

management planning within the region and may extend into surrounding sections of Caddo and Bossier Parishes.

For purposes of this Preliminary Implementation Plan component, the defined coverage area commensurate with the system design life will be the deployment limits and coverage identified in *Section 3.0*. DOTD, the City/Parish Governments, and the Northwest Louisiana Council of Governments (NLCOG) will work closely together to determine if coverage should be expanded in the future.

5.5 Overview of Concept of Operations/Relationship to Statewide Implementation Plan

5.5.1 General Issues and Considerations

Through the Louisiana ITS Statewide Deployment Program, TMCs will be deployed in major metropolitan areas statewide. A Concept of Operations plan developed before the TMC is implemented provides a strong sense of direction, and understanding is gained by documenting the TMC mission and goals. The TMC becomes even more effective when backed up by an ongoing performance analysis and process improvement. The ITS systems installed today provide for fully automated logging of data, status and actions, making such analysis possible. Developing and documenting a Concept of Operations forces the stakeholder agencies to explicitly address and understand operations issues, such as staffing, education and training, information and control sharing, and the decision making hierarchy. It also assists in more clearly defining the system configuration and information content, user interface, and other systems parameters that directly affect and interact with the Communications Network. One of the main goals for developing the Concept of Operations plan is that the system will match the users functional requirements.

General management, operations, and maintenance considerations are listed below:

- A core set of personnel should be assigned to lead and oversee the TMC primary functions. A lack of adequate staff in the appropriate classifications and with the right skills can cause ongoing stress in achieving the TMC goals and objectives.
- The TMC needs to develop plans for how they would operate under emergency conditions or how they would manage the road network in emergencies. These plans need to be revisited regularly. It has been observed that a TMC where emergency conditions were more common might have simultaneous emergency scenarios (e.g., hurricane and flooding).
- Once a TMC is operational, public and other agency expectations for their assistance build rapidly, it will be extremely important that basic operational issues are addressed.

- Interaction with partner agencies in the incident management process is one of the most important and complex components of TMC operations. Some TMCs have law enforcement officers on-site at the TMC as well as dispatchers cohabiting the control room. Interagency coordination is also critical for special event planning. Meetings were held with three local law enforcement agencies including the City of Shreveport Police Department, Bossier City Police Department and the Louisiana State Police. While all three agencies expressed interest and the need to integrate certain systems, none of the three agencies plan to provide full-time on-site personnel at the RTMC. The three agencies did express interest in having a workstation available to them during emergency events and for associated coordination efforts.
- Intra-agency coordination typically involves interaction among planning, design, construction, inspection, operations and maintenance functions within the department of transportation (DOT). Effective intra-agency coordination can significantly improve the efficiency of the TMC and help support the DOT in its overall mission.
- Understanding the TMC activity and experiences and ability to access the information it collects can be invaluable to the planning department in assessing future transportation needs and priorities. The engineering department, in designing similar systems for other parts of the state, makes the overall system easier to administer and simplifies many of the institutional processes (procurement, contracting, and human resources).
- Studies show that TMCs realize the full benefits of transportation management only when the control of freeways and surface streets is performed in an integrated manner. Although integration typically requires coordination across agency lines, performing integrated total network management is viewed as desirable by almost all TMCs. It has also been shown that substantial benefits result from developing cooperative relationships between traffic management, law enforcement, and emergency operations agencies. Centralized integration features personnel from the various stakeholder agencies in the TMC facilities. Decentralized integration is also possible through extensive electronic sharing of voice, data, video, and control capabilities over the Communications Network between the TMC and other centers.
- In situations where the transit fleet will depend on the roads managed by the TMC, (e.g., expressways and circulator routes) the value and extent of integration can be significant. Also in situations where the TMC detection and surveillance networks are limited, information from transit operations (e.g., buses serving as traffic probes) can significantly expand the traffic network information available to the TMC.
- Unit pricing is very important on items. Placing no price or value on such items will make it both difficult to ensure satisfaction and to change if the need should arise. Similar difficulties were experienced by one TMC that used very few bid items to procure its entire system.

- Mixing generic, performance and detailed specifications in a single TMC acquisition will lead to difficulty in obtaining the desired flexibility while controlling the risk distribution within the project.
- The agency responsible for implementing the TMC must predetermine in the concept design study the purpose of the TMC and then ensure that the traffic management system will support that purpose effectively. A system design that does not address and support the specific, known transportation needs of the region or does not support the involved agencies' long term transportation strategy could result in negative public and political reaction and many challenging years of ITS program management.
- Traffic Management Center locations should provide easy access to the interstate network for which they are responsible. This provides value in easy convenient access for both passenger vehicles and for larger, more unwieldy maintenance and construction vehicles, which close proximity to the highway, would provide.
- Adequate room must be provided in a TMC, and if possible should address a plan for facility expansion as space needs increase. Often TMCs discover that when their site is operational an ongoing stream of agencies and functions found it beneficial to locate within the TMC.
- Security needs to be addressed, In most cases the security needs will be driven by two factors: by the location and by the services to be provided in the TMC. The security level can vary from complete and free accessibility (except for the control room) to where "swipe cards" are needed for every room, stairwell and elevator.
- Emergency operations are a form of special event that often stress the TMC's resources. The TMC design needs to have some form of un-interruptible power supplies and/or diesel generators to ensure their system operations during crises situations. One effect of this demand is that the TMC implement computer systems that have significant redundancy so that they remain operational even if aspects of the primary computer systems fail.
- TMCs that host both traffic management and emergency management capabilities need to be properly configured and outfitted for that mission. Appropriate requirements typically include adequate sizing of backup power units, communications connections and accommodations for personnel working around the clock. It is also important in multi-agency circumstances that each agency have some "home turf" in the TMC in which it could comfortably address sensitive internal issues away from other TMC residents.
- In TMCs where multiple elements of the ITS program (planning, design, construction, inspection, operations and maintenance) are co-located there is significant value gained by designing laboratory and testing facilities into the TMC. These facilities support evaluation of new equipment, testing and calibration of new and repaired units and debugging of interfaces between the equipment and computer and communications systems.

- TMCs have noted that it is beneficial to provide dedicated space to the media within the center (typically in or adjoining the control room) they state this supports an effective (and less disruptive) media relationship.
- A common challenge in control rooms is managing the level of noise, particularly when radios and scanners are being used, including locations where the control center receives incoming communications such as cellular 911 or “DOT”. Generally control centers find that operators may prefer headsets while others prefer handsets to communicate with outside organizations.
- The use of technology by the typical TMC requires skills from a significantly different paradigm than those required for implementing roadways. The usable lifetime of TMC technologies and their need for active maintenance differs greatly from traditional road infrastructure. An agency would be considered foolish if it began replacing road surface a year or two after paving it. Yet not replacing computer hardware frequently might condemn the TMC to extremely limited functionality, rapidly escalating operational costs, and increased difficulty in obtaining support and replacement parts. When TMC operations staff members are hired, bringing them up to speed and keeping them informed of proper procedures is critical for ensuring successful operations.
- Effective TMC maintenance, including its field equipment, is critical for ensuring the TMC’s ability to perform its duties and functions. The maintenance skills a TMC requires of its personnel, particularly for computer systems and communications can be hard to find and keeping the qualified personal needed is an ongoing challenge. The TMC may find the need to contract this type of work, keeping in mind there is a significant difference between services covered by “warranty” and “maintenance”. The TMC needs be quite clear which was desired before contracting for either. Warranties typically do not include repairs of damage from weather, vandalism, improper operation, or vehicle impact. The amount and type of preventive maintenance performed under a warranty is typically at the discretion of the warrantor. The type of service (return for repair vs. repair/replace in place) also varies depending on the specifics of the warranty contract.
- Maintenance contracting by low bid with no pre-qualifications can be particularly perilous, Because much is left to chance in acquiring an effective contractor. Also important is to carefully specify all skills and duties required because general contractor categories (such as electrical contractors) might not offer a full set of the needed skills (such as communications technology). Also specifying the types of equipment required for maintenance is crucial. URS has experienced situations where its contractor did not have appropriate bucket trucks to safely reach the installed equipment. Superior results can be achieved by separating maintenance contracts based on the type of device being maintained, with one contractor supporting variable message signs maintenance and the other supporting other devices. This can create coordination problems when multiple contracts cover a specific failure or incident (e.g., a vehicle strikes a pole with several services mounted to it). A master contract for maintenance utilizing sub-contracts can provide satisfactory results.

Management and issues specific to the Shreveport/Bossier City region are presented in the following Section.

5.5.2 Overview of Shreveport/Bossier City Concept of Operations

The center of operations for the Shreveport/Bossier City metropolitan regional ITS deployment, including the Freeway and Incident Management and the Advanced Surface Street Control Systems, will be the control room located within the planned Regional Transportation Management Center (RTMC). No site has been formally agreed to, however the existing DOTD District 04 office in Bossier City is under consideration. The RTMC for Shreveport /Bossier City will be part of the Louisiana Transportation Information System (LATIS) and be linked to the other planned Traffic Management Centers (TMCs) across the state. All TMCs will be connected using the State fiber network. This concept of operation would allow the Shreveport/Bossier City RTMC to close during emergencies and the operators to evacuate to another TMC, yet still allow for the operation of the system from remote locations if the communication systems are still operable. It would also allow other TMCs in the southern part of the state to be operated remotely from Shreveport in the event of a major hurricane evacuation in southern Louisiana.

Until such time as the permanent RTMC facility is constructed and operational, DOTD, the City of Shreveport, and Bossier City will operate Interim TMC systems from their respective interim Traffic Operations Centers.

During the interim period between the implementation of the immediate term improvements and the opening of the Regional Transportation Management Center, DOTD, the City of Shreveport, and Bossier City will all operate interim TMC operations.

Interim Concept of Operations

DOTD Interim TMC Operations. The Reduced Visibility Enhancement Program (variable message signs) which is currently being implemented will be operated from the DOTD District 04 offices. The interim traffic management system equipment will be housed at the District 04 offices and will include the computer, monitor, required communications equipment and operating software to operate the Reduced Visibility Enhancement Program (variable message system). During the interim period DOTD District 04 will utilize two of their existing personnel to operate the system. DOTD personnel assigned to operate the system will be equipped with direct communication access to state and local police (cell phone and beeper) and they will have the ability to operate the system from their DOTD offices during working hours. Operations personnel will also be assigned a laptop computer, which will provide the capability through a dial-up mechanism to operate the system from remote locations. Coordination with local and state police dispatch will be instituted so major incidents and severe weather condition hazards, once verified, are immediately communicated to the DOTD operations personnel who, in turn, can quickly institute system response.

City of Shreveport Interim TMC Operations. The City of Shreveport currently operates a circa 1970's UTCS centralized traffic signal system from their existing traffic engineering office. One operator is assigned full time during workdays (8:00 a.m. to 5:00 p.m., Monday through Friday) to monitor the system. The planned immediate term improvements Phase 1, 2, and 3 are comprised of upgrading the surface street control system along primary corridors in Shreveport (see ***Section 3.0*** for details). These improvements are planned for implementation and will be operable prior to the completion of the Regional Transportation Center. During this interim period the immediate term deployment Phase 1, 2, and 3 will be operated from the existing Shreveport Traffic Management Center. All interim TMC equipment including computers, monitors, servers, communications equipment will be housed there. Existing Shreveport traffic operations personnel will operate the system from 8:00 a.m. to 5:00 p.m. on weekdays. Interim communication between the master controllers and the interim Shreveport TMC will be via leased lines (T1 circuit) to accommodate voice video and data. Select staff will have remote access to master controllers via dial up service for after hours operation.

Bossier City Interim TMC Operations. Bossier City currently operates a Traffic Management Center for their surface street control system. The system is relatively new and functional. The immediate term improvements will have minimal impact on the existing Bossier operations, therefore Bossier will continue to operate status quo in the interim period.

Concept of Operations

Through extensive discussion with the Technical Advisory Committee, a Near to Mid Term and a Long Term concept of operations has been defined for the Shreveport/Bossier City Metropolitan regional ATMS system. Both approaches include one regional central control and operations facility (Regional Transportation Management Center) from which the freeway and incident management system, roadway weather information system, and advanced surface street control system for the Cities of Shreveport, Bossier City and the surrounding urban areas would be operated. The following describes the Near to Mid Term operating alternative being considered:

- Near to Mid Term Concept of Operations - *Separate but integrated operating entities located within one central RTMC.*

Under this scenario the three primary participants, City of Shreveport, Bossier City and DOTD would all be responsible for operating their specific component of the ATMS, however all components would be housed and operated from one central control facility (RTMC).

- DOTD would be responsible for operation and maintenance of the Freeway and Incident Management System and Roadway Weather Information System.
- City of Shreveport would be responsible for operation and maintenance of the Advanced Surface Street Control System within the City of Shreveport / Caddo Parish.

- Bossier City would be responsible for operation and maintenance of the Advanced Surface Street Control System within Bossier City / Bossier Parish.

Operations would be integrated, but each primary participant would provide their own staffing and personnel. Under this scenario the three primary participants would be jointly responsible for operating the regional ATMS system but with each participant having specific responsibilities for which systems they operate and maintain.

- Long Term Concept of Operations – *Single operating entity fully integrated and located within one central RTMC.*

The primary difference between this operating alternative and the Near to Mid Term Concept of Operations is the RTMC personnel and staffing would be employed by a single entity, such as DOTD or a Regional Transportation Management Authority. Under this concept, funding would be provided by all three participants to operate all components of the regional ATMS system. A formula for cost sharing would need to be developed. This scenario will allow for uniform compensation and benefit packages for employees performing similar tasks.

Initially the permanent RTMC days of operation will be seven days per week. Weekday operations will be from 6:00 AM to 7:00 PM, with likely weekend operating hours from 8:00 AM to 6:00 PM. Long term a 24-hour a day 365-days/year operation is envisioned. For details regarding organization, staffing, job functions and shifts refer to **Sections 6.0** and **7.0**.

Procedures and policies relative to the management of severe weather conditions and special events will be established by the TMC Operations Committee (see **Section 6.0**) prior to the opening of the RTMC. The ATMS Manager, who will reside at the RTMC, will be responsible for both the operations and maintenance of the regional ATMS.

Maintenance of equipment, hardware and software within the RTMC as well as equipment deployed in the field associated with the Freeway and Incident Management System, Roadway Weather Information System, Advanced Surface Street Control System will be provided by trained DOTD, City of Shreveport and Bossier City maintenance staff and/or via an agreement with a contract maintenance service provider. If utilized the provider will supply labor, parts and spare parts storage capability for preventive and general maintenance functions.

SPORTTRAN will operate their permanent Transit Management Center from their existing Transit Dispatch Center. The Transit TMC will be linked via a fiber optic connection to the RTMC and data exchange requirements and needs will be integrated between the two centers. Transit system deployment and communication links will be funded through transit acquired funding sources.

6.0 INSTITUTIONAL ARRANGEMENTS

The planning, implementation, and operation and maintenance of the proposed Advanced Traffic Management System (ATMS) for the Shreveport / Bossier City metropolitan region will involve numerous organizations and multiple levels of government. In this section the organizational structure and responsibilities for the various elements of the ITS system will be discussed.

Included will be a discussion of the roles of the Louisiana State ITS Administration Board, the Regional ITS Policy Committee, and the RTMC Operations Committee, and the roles and responsibilities of the primary participating agencies based on the two Concepts of Operation outlined in Section 5.0.

To begin with, a listing of primary participating and coordinating organizations is provided (See *Table 6.1*).

Table 6.1 Participating and Coordinating Organizations

Organization	Project Liaison	Phone Number
Louisiana Department of Transportation and Development		
State ITS Engineer	Stephen Glascock	(225) 389-2141
DOTD District 04 Administrator	Bruce Easterly	(318) 549-8301
State Traffic Engineer	Peter Allain	(225) 935-0103
District 04 Traffic Operations Engineer	Keith Tindell	(318) 549-8305
Transit Division	Carol Cranshaw	(225) 379-1728
Louisiana Transportation Research Center	Joe Baker	(225) 767-9131
Other Organizations		
Federal Highway Administration	John Broemmelsiek / Mary Stringfellow	(225) 757-7614
Northwest Louisiana Council of Governments	Kent Rogers / Wayne Gaither	(318) 841-5959
State Police/Louisiana Emergency Response Commission	Major Mark Oxley / Jim Mathews	(318) 741-7402
SPORTRAN	Gene Eddy	(318) 673-7400
City of Shreveport		
City Traffic Engineer	Mike Erlund	(318) 673-6181
Director, Department of Operational Services	Mike Strong	(318) 673-7660
Shreveport Police Department	Wayne Smith	(318) 673-7262
City of Bossier City		
City Engineer	Mark Hudson	(318) 741-8565
Traffic Department Superintendent	John Kelly	(318) 741-8434
Bossier 911	Tracy Hilburn	(318) 965-2911
Bossier City Police Department	Ken Viola	(318) 741-8776

6.1 Organizational Responsibilities

While there are numerous participating and coordinating agencies associated with ITS deployment within the Shreveport / Bossier City metropolitan region, the key organization that will be primarily responsible for design, implementation and integration of the systems will be DOTD. DOTD will also likely play the most significant role regarding operation and maintenance of the Advanced Traffic Management System (ATMS) and the Regional Transportation Management Center (RTMC) for the Shreveport / Bossier City metropolitan region.

Near to Mid Term Concept of Operations *Separate but integrated @ RTMC*

Under this Concept of Operations, DOTD will be responsible for the following:

- Design and implementation of the Freeway and Incident Management System and Roadway Weather Information System on the Interstate system and other state routes identified in the ITS Strategic Plan. (**Section 3.0**)
- Design and implementation of Advanced Surface Street Control projects on state routes.
- Design and implementation of the Regional Transportation Management Center (RTMC).
- DOTD would own the Regional Transportation Management Center (RTMC building).
- Maintenance of ITS related hardware, software and other equipment located within the RTMC. However the City of Shreveport and Bossier City would participate in a percentage of maintenance costs such as power for operations of the facility and equipment at the RTMC.
- Providing necessary staffing for the operations of the Freeway and Incident Management component of the regional ATMS. The City of Shreveport and Bossier City would staff the Surface Street Control component.
- Operations and maintenance of traffic control devices on Federal and State routes associated with the ATMS, which are integrated into and are part of the DOTD Regional Advanced Traffic Management System. (Excludes City of Shreveport and Bossier City Advanced Surface Street Control Program.)

The DOTD will be responsible for maintenance of field ITS devices within DOTD right-of-way, including power distribution and communications equipment not owned and/or maintained by a private utility provider. DOTD will also be responsible for annual power usage expenses and associated communication leases, which may be required. The DOTD will provide trained in-house staff or contract personnel for maintenance services to maintain ITS field devices located within DOTD right-of-way. Provisions for spare parts and storage of spare parts will be accommodated by DOTD or through the contract maintenance service provider.

Design services for the RTMC will be procured through the DOTD. Design and integration of other planned ATMS components will be handled through the existing System Manager procured by DOTD, the PB Farradyne Team. Future procurement of implementation of the ATMS will be conducted by DOTD in cooperation with respective City/Parish Government jurisdictions where necessary.

The City of Shreveport Traffic Engineering Division currently operates and maintains signalized intersections (both City owned and DOTD owned) via an existing operation and maintenance agreement between DOTD and the City of Shreveport. The operation and maintenance of the planned computerized traffic signal system upgrades within the City of Shreveport would be inclusive in this agreement. The city of Shreveport Advanced Surface Street Control improvements are outlined in the Strategic ITS Deployment Plan (**Section 3.0**).

The City of Shreveport will be responsible for operating the Advanced Surface Street Control System within Shreveport. They will be responsible for providing personnel and staffing at the RTMC to operate the City of Shreveport Advanced Surface Street Control System.

The City of Shreveport would participate in the maintenance costs at the RTMC attributable to their surface street control component i.e., cost of power, equipment maintenance, building maintenance, etc.

The City of Bossier Traffic Engineering Division currently operates and maintains signalized intersections (both City owned and DOTD owned) via an existing operation and maintenance agreement between DOTD and Bossier City. The operation and maintenance of the planned computerized traffic signal system upgrades within Bossier City would be inclusive in this agreement. The Bossier City Advanced Surface Street Control improvements are outlined in the Strategic ITS Deployment Plan (**Section 3.0**).

The City of Bossier will be responsible for operating the Advanced Surface Street Control System within Bossier City. They will be responsible for providing personnel and staffing at the RTMC to operate the Bossier City Advanced Surface Street Control System.

Bossier City would participate in the maintenance costs at the RTMC attributable to their surface street control component i.e., cost of power, equipment maintenance, building maintenance, etc.

Long Term Concept of Operations – Single Operating Entity. The DOTD, City of Shreveport, and Bossier City responsibilities as outlined for the Near to Mid Term Concept of Operations would remain primarily the same under this Concept of Operations with the exception of the following:

- Operations of the system would be performed by a designated single operating entity such as DOTD or a regional transportation authority. All personnel would be employed by the designated single regional operating entity to establish consistent compensation and benefits packages for employees.

- Each participating entity (i.e., Shreveport, Bossier City and DOTD) would provide funding for operations and maintenance of the RTMC based on a cost sharing agreement. The designated regional operating authority would be responsible for operation and maintenance of the RTMC.
- Each participating entity would still be responsible for maintenance of field devices and communication plant and associated equipment consistent with the Near to Mid Term Concept of Operations.
- If agreed to by all participating entities, a regional maintenance approach could be investigated and considered in which personnel and resource sharing among each of the three participating entities could be instituted.

The Motorist Assistance Patrols (MAP) are currently funded through DOTD in association with the on-going interstate reconstruction projects along I-20 and services as a congestion mitigation measure for construction related impacts. DOTD will continue funding the MAP through the completion of the I-20 reconstruction projects and are committed to maintaining funding during the reconstruction. This will assure the continued funding of the MAP through the near term. Once the interstate reconstruction projects are completed the MAP patrols would be continued via a potential agreement between DOTD and the region utilizing 50% federal funds and 50% local funds.

Once the permanent RTMC is functional, the MAP patrol operations will be integrated into the ATMS operations and will be coordinated through the ATMS Manager. Communications between ATMS operators at the RTMC and in-vehicle MAP patrol personnel will be implemented utilizing RF and cellular communications.

The lead organization for the Advanced Public Transit component will be SPORTRAN, the local transit agency. SPORTRAN will be responsible for procurement, operations and maintenance of the proposed Advanced Vehicle Location / Computer Aided Dispatch System, as well as their Advanced Transit Management Center to be housed in the existing SPORTRAN Transit Center and administration building.

SPORTRAN will operate and maintain the Public Transit System and the Transit Management Center. SPORTRAN operations will be integrated into the RTMC operations via a communication link, which will allow for data exchange and sharing data relative to real-time traffic conditions, and incident locations. This data will be made available to SPORTRAN personnel at the Transit Management Center.

Emergency management functions will be integrated into the RTMC operations. The lead agency relative to emergency management on the local level will be City/Parish EMS 911 and City Police and the lead state agency will be the Louisiana State Police. All integration of emergency management operations will be closely coordinated between the ATMS Manager, the City/Parish EMS 911 Directors and State Police in close cooperation with the City/Parish Fire Departments, Police agencies and Office of Emergency Preparedness. Specific policies and procedures relating to Incident Management, and other emergency operations will be developed

and coordinated through the ATMS Manager, the RTMC Operations Committee, the Regional ITS Policy Committee, and the Transportation Incident Management (TIM's) Committee consisting of local and state emergency management agencies. There are currently existing cooperative agreements between emergency response agencies (Fire, Police, and EMS) as to agency responsibilities and protocols during emergency responses, which will also be incorporated into the ATMS operations.

As previously noted, ITS Commercial Vehicle Operation (CVO) initiatives are statewide deployment oriented. While important to the Shreveport/Bossier City metropolitan region, the DOTD, State of Louisiana and State administrative and regulatory agencies for commercial vehicle operations must take the lead for deployment. The DOTD in cooperation with the Louisiana Motor Transport Authority will be the coordinating agencies for any ITS CVO statewide initiatives which impact the Shreveport/Bossier City metropolitan region.

The planning, research and performance evaluation of existing and future ITS deployments within the Shreveport/Bossier City metropolitan region will be the joint responsibility of NLCOG, LTRC and DOTD. NLCOG and DOTD will be responsible for future ITS planning within the Shreveport/Bossier City metropolitan region and data archive functions. LTRC will be the primary research organization. Performance evaluation of implemented ITS components will be shared between NLCOG, DOTD and LTRC.

6.2 DOTD Organizational Structure for Management

The DOTD has established through the *DOTD Policy on Management and Operations of Traffic Management Centers and Intelligent Transportation Systems*, an organization structure for the management and guidance of ITS Deployments and continuing operations and maintenance in urban areas.

Consistent with this DOTD Policy, the DOTD ITS Administration Board will be responsible for administering the state's priority program for ITS, including making all executive-level financial decisions for the Shreveport/Bossier City Regional Deployment. Members of this board include:

- DOTD ITS Engineer Manager – Steve Glascock
- DOTD State Traffic Engineer – Peter Allain
- DOTD Highway Needs Engineer – Mike Schiro
- State Police Representative – To be named
- DOTD District Administrators –(including Bruce Easterly)
- DOTD Highway Safety Engineer –Dan Magari
- User Representative (appointed by ITS Engineer Manager) – To be named

A Regional ITS Policy Committee will also be established specific to the Shreveport/Bossier City metropolitan region. The District 04 Administrator will be responsible for coordinating and managing activities of this committee. This policy committee will be responsible for establishing and updating the regional ITS priority program through the TIP and addressing operational responsibilities and funding requirements for the RTMC. This committee will also be responsible for developing a process for resolving policy-level conflicts to ensure appropriate agency representation and voting strength that is compatible with each agency's financial commitment. The ITS Engineer Manager will consult with the Chief Engineer Office of Highways and Assistant Secretary Office of Operations in the event of critical policy-level conflicts. Committee members will include:

- DOTD District 04 Administrator (Chair) – Bruce Easterly
- DOTD ITS Engineer Manager –Steve Glascock
- Local Government Agency Representatives (2)
 - City of Shreveport appointee
 - City of Bossier City appointee
- Metropolitan Planning Organization (MPO) Representative –Kent Rogers
- Federal Highway Administration Representative –John Broemmelsiek

A RTMC Operations Committee will also be established drawing on DOTD District and local government participation in a TMC environment, which will include the following personnel.

- TMC Facility Manager (Chair) – to be determined
- DOTD District Traffic Operations Engineer –Keith Tindell
- MPO –Kent Rogers and Wayne Gaither
- State Police –Mark Oxley / Jim Mathews
- City of Shreveport Police Department –Wayne Smith
- Bossier City Police Department –Ken Viola
- City of Shreveport –Mike Erlund
- City of Bossier City –Mark Hudson / John Kelly
- Bossier 911 –Tracy Hilburn

The TMC Operations Committee's responsibilities will be to identify and direct operational responsibilities of participating agencies in the TMC, resolve basic conflicts that do not require policy or executive level intervention, and oversee operational functions and integration maturity of the RTMC.

Figure 6.1 reflects the high-level organizational structure.

6.3 Needed Legislation

Several issues have been discussed relative to existing regulations and policies affecting implementation of the proposed ITS deployment. However, most issues noted through the "Preliminary Implementation Plan" development process have been previously addressed via implementation of legacy ITS systems or implementation of similar systems in other regions of Louisiana.

The DOTD has implemented several ITS related systems and currently operates and maintains these systems with in-house staff and/or through agreements with other agencies or private contract maintenance providers. Previous ITS related systems and equipment, which have been deployed include computerized traffic signal systems, CCTV Cameras, highway advisory radio, vehicle detection stations on both arterial and interstate roadways, and variable message signs (portable), typically in and adjacent to construction zones.

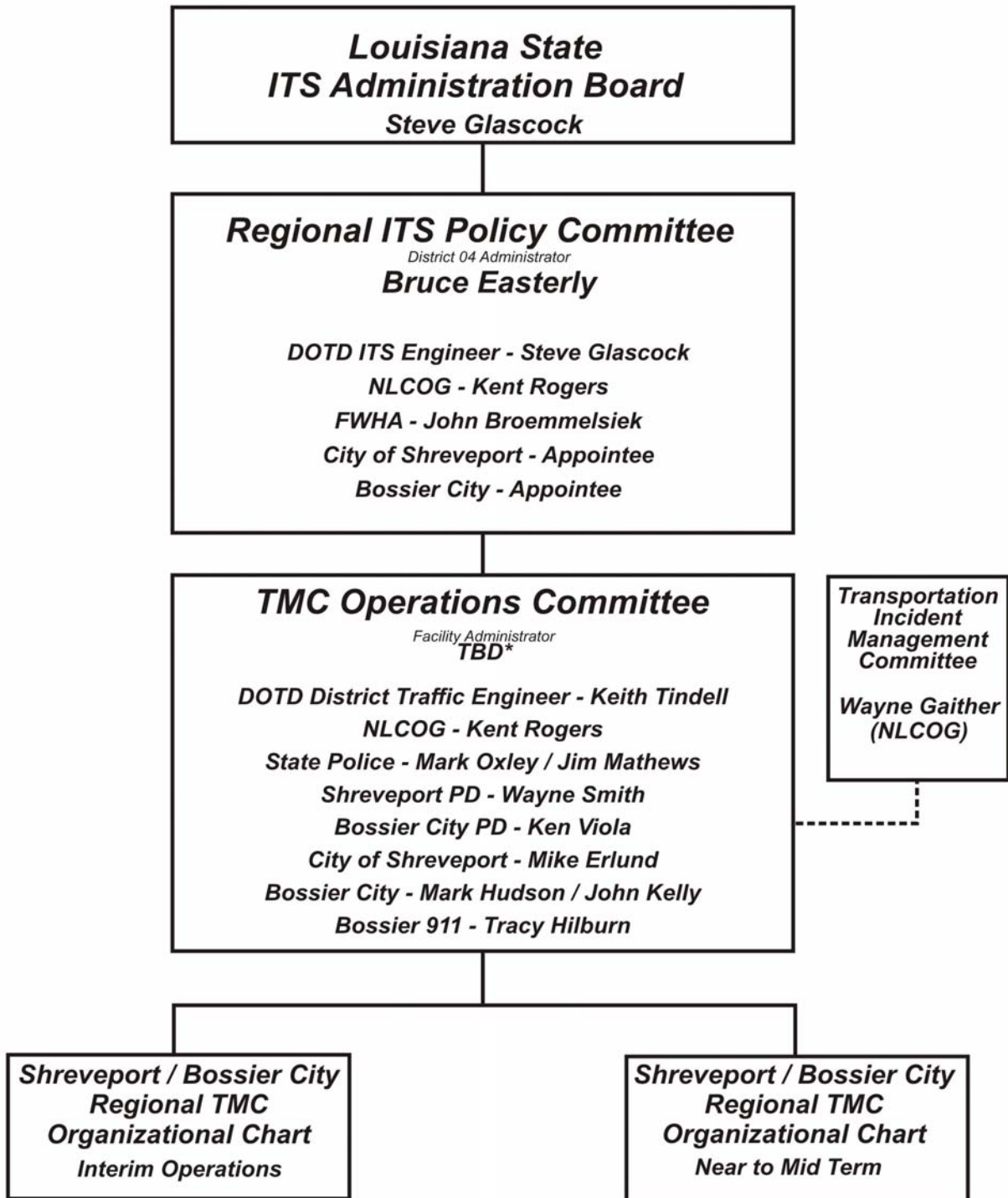
It should be noted that the detailed policies and procedures for operation of the ATMS will be established by the Regional ITS Policy Committee and the RTMC Operations Committee as previously noted during future phases of project development. Once detailed policies and procedures are developed for operations of the ATMS, further investigation relative to existing legislation and regulations, and their effect on implementation of the proposed policies and procedures may need to be performed.

6.4 Coordination with Metropolitan Transportation Planning Process

Priority ITS strategies and projects for deployment and implementation are defined in this ITS Strategic Deployment Plan. The Strategic Plan should be updated periodically, likely consistent with the Long-Range Transportation Plan Updates performed under the guidance of the Federal Metropolitan Planning process. Annual ITS planning will be performed by the local MPO in coordination with DOTD as part of their annual transportation planning process. The MPO will work in collaboration with the Regional ITS Policy Committee to establish priorities for ITS deployment and include agreed to priorities in the Transportation Improvement Plan (TIP).

Shreveport / Bossier City Regional ITS Organizational Chart

Figure 6.1



TBD* - To Be Determined

7.0 PERSONNEL AND BUDGET RESOURCES

An important component of ITS systems implementation is the operations and maintenance of the system. The central point of operations for the Shreveport/Bossier City region-wide Advanced Traffic Management System (ATMS) will be the Regional Traffic Management Center (RTMC).

The RTMC will be owned by DOTD, and DOTD, with participation from the City of Shreveport and Bossier City, will operate and maintain the facility. The RTMC will be operated under the direction of the DOTD District 04 Administrator and the RTMC Operations Committee. For the Near to Mid Term Concept of Operations an ATMS Manager will be appointed to manage the DOTD operations of the RTMC. He will also work in close coordination with the Shreveport and Bossier City operating components of the RTMC. The ATMS Manager will work under the direction of the DOTD District 04 Administrator and Regional ITS Policy Committee.

As previously mentioned, in order to develop policy and procedures and to avoid conflicts or misunderstandings concerning operations, a RTMC Operations Committee will be established. This RTMC Operations Committee will set overall policies and procedures for the operations of the ATMS system in the Shreveport/Bossier City metropolitan region, but will not be involved in day-to-day management and operations of the RTMC. Subcommittees involving Fire; Police; EMS; Emergency Operations Center management personnel; and representatives of local parishes and cites will be utilized to develop consensus agreements by all relevant parties to policies and procedures where necessary.

7.1 Job Functions and Descriptions

One of the first job functions to fill will be that of the ATMS Manager. In the Near to Mid Term Concept of Operations this person will be responsible for the overall ATMS system development, and operations and maintenance of the DOTD Freeway and Incident Management System. This person will coordinate with the City of Shreveport and Bossier City Operations Manager at the RTMC and will provide coordination for future ITS deployment, as well as coordination with other agencies and organizations, and work closely with the TMC Operations and Regional ITS Policy Committees to develop and implement policies and procedure for incident and freeway management. Another key responsibility will be to financially manage the DOTD operations by developing budgets and being responsible for operating within these budgets.

In the Long Term Concept of Operations it is envisioned that the ATMS Manager position will evolve into the RTMC Administrator role with overall responsibility of all operations at the RTMC including Freeway and Incident Management and Advanced Surface Street Control.

Operations and Maintenance Supervisor positions will also be required. From the operations side this person will provide day-to-day supervision and scheduling of ATMS operators and will also be available to support ATMS operators during a major incident, to provide a higher level

liaison with other agencies and the media, and to serve as a back-up person if regular operations personnel are not available. The Operations and Maintenance Supervisor will also be responsible to ensure that new operations personnel are trained properly and to ensure that current staff are trained on new equipment and that refresher training is conducted for all personnel. Operations and Maintenance Supervisors for the City of Shreveport and Bossier City will supervise traffic operators / technicians who operate the Surface Street Control System.

From the maintenance side, this person will be responsible for supervision of maintenance personnel or the contract maintenance provider to ensure that preventative maintenance is being performed according to schedule and system malfunctions and/or maintenance needs are responded to promptly.

ATMS operators will be required and will have numerous responsibilities including:

- Monitoring of CCTV screens and computer displays to verify traffic conditions and incidents on the ITS network.
- Systems operation to select different displays and messages to control field devices, such as Dynamic Message Signs, CCTV cameras, and Highway Advisory Radio.
- Coordination using communication equipment with incident response personnel during an incident.
- Providing relevant information as approved by ATMS Manager to the information service provider and the media.
- Maintaining logs and other required records of incidents and activities.

Traffic operators/technicians will perform similar activities with the focus on the surface street control system. Responsibilities will also include down loading of timing plans and monitoring the computerized traffic control system.

Maintenance technicians will be required including electronics and system technicians who are experienced in electronics, communications, power distribution, cable installation and repair, portable generators, and general small-scale mechanical repairs. Due to the diversity of equipment and potential malfunctions, a broad range of general repair capabilities is required. The maintenance technicians will also be responsible for troubleshooting and problem identification, to quickly identify and correct problems. Preventive maintenance, locating and repairing small problems before they become major and conscientious record keeping and documentation are also typical responsibilities of maintenance technicians.

7.2 Organization and Staffing

7.2.1 Interim Organization and Staffing

An Interim Organization and Staffing Plan will be necessary to accommodate the Planned Interim Deployment, which will be operational prior to the completion of the Regional Traffic Management Center (RTMC).

The Interim Deployment will include the Reduced Visibility Enhancement Project (currently being implemented), Immediate-Term Phase 1, 2 and 3 improvements and Near-Term Phase 1 improvements, possibly. The major system components that will be included in these projects are:

1. Fiber and wireless Communications Network equipment
2. Traffic Signal Control Systems
3. Closed Circuit Television Camera System (CCTV)
4. Dynamic Message Sign System (DMS)
5. Radar Vehicle Detection System (RVD)
6. Interim Traffic Management Centers (ITMC) at DOTD District 04 and at Shreveport Traffic Engineering Services Building

The interim traffic management components will be operated in coordination to improve traffic flow on arterial streets, improve efficiency of operation and maintenance of the system and provide motorists with real-time traffic information.

Primary command and control for the Reduced Visibility Enhance Program (DMS System) will be at the DOTD District 04 Traffic Operations office. DOTD personnel will be able to monitor, control, and manage the DMS devices in real-time through the use of vendor supplied Control Software. The Statewide ATM SONET network will provide, in the future, the opportunity for remote monitoring and shared control from other locations, such as the DOTD Traffic Services office in Baton Rouge.

During this interim period, the Immediate Term Deployment Phase 1, 2 and 3 if operable, will be operated from the existing City of Shreveport Traffic Management Center. All new interim TMC equipment including computers, monitors, servers, and communications equipment will be housed there. Existing City of Shreveport traffic operations personnel will operate the system from 8:00 a.m. to 5:00 p.m. on weekdays. Interim communication between the field controllers and the interim Shreveport TMC will be via leased lines to accommodate voice, video and data. Selected trained staff will have remote access to field controllers via dial up service for after hours operation.

Bossier City currently operates a Traffic Management Center for their Surface Street Control System. The system is relatively new and functional. The immediate term improvements will have minimal impact on the existing Bossier operations, therefore Bossier will continue to operate status quo in the interim period in coordination with the Shreveport and DOTD Interim TMC Operations.

A proposed Interim ITS Organizational Chart showing the organization and staffing scheme during the “Interim” period between the completion of the Immediate Term Deployment and the opening of the RTMC is shown in *Figure 7.1*.

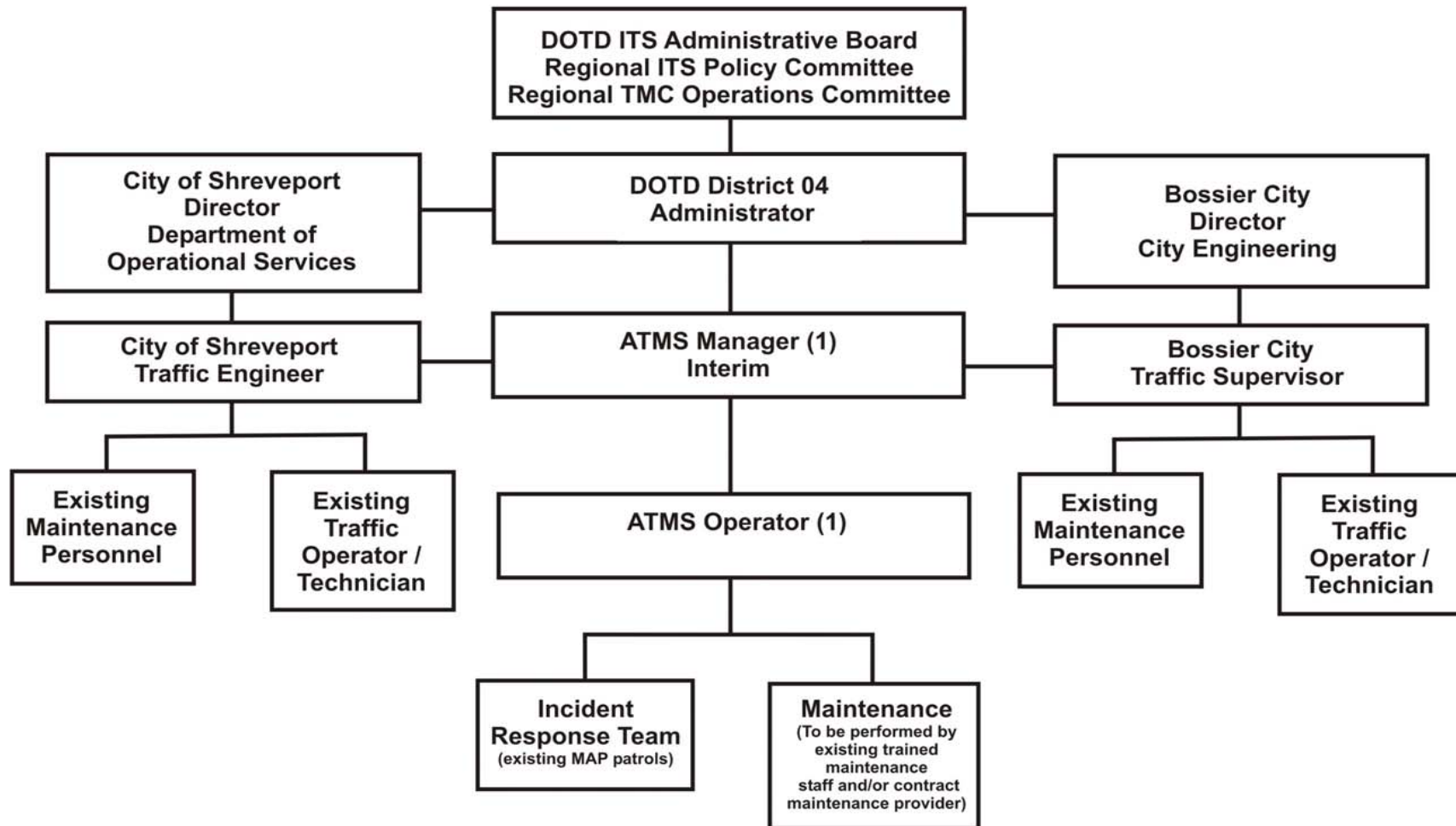
The organizational chart shows the entire Interim TMC operations. DOTD operations will fall under the direction of the DOTD District 04 Administrator, Bruce Easterly. The ATMS Manager (Interim) will report directly to the District 04 Administrator and will be the primary liaison between the ATMS staff, the City of Shreveport and Bossier City Traffic Engineers and the TMC Operations and the Regional ITS Policy Committees regarding development of operating policies and procedures. Existing staff at the DOTD District 04 office will provide ATMS Manager and operator functions for the DMS System. Existing operations and maintenance personnel at the City of Shreveport Traffic Engineering Department will provide operations and maintenance for the Phase 1, 2, and 3 Immediate Term improvements.

During the “Interim” period the days and hours of operation for the Interim Shreveport and Bossier City TMC operations will be five days per week, Monday through Friday, 8:00 a.m. to 5:00 p.m. One existing traffic operator will be required with the support of the City Traffic Engineer. Select, trained staff will have remote access to Master Controllers via dial-up service for after hour operations and weekends. These personnel will also have remote mobile communications with the Immediate Term Advanced Traffic Control System to allow quick response to built-in alarm systems at remote locations and after hours.

For the Visibility Enhancement Component, DOTD will operate the system between 8:00 a.m. and 5:00 p.m. from their Interim TMC located at the District 04 offices. Under this interim operating scenario two existing DOTD District 04 staff members would be trained as ATMS operators and provide part-time operator functions. The extra operator would be available to accommodate absences such as sick and vacation time. The DOTD District Traffic Engineer, Assistant Traffic Engineer and/or another senior DOTD District 04 staff member would be trained as per the operating policies and procedures of the ATMS operation and at a minimum, one of these personnel will be available during operating hours to respond to incidents. Select, trained staff will have remote access to Visibility Enhancement Devices (DMS) via dial-up service for after hour operations and weekends.

In the “Interim Phase,” all ITS components are comprised within Phase 1, 2, and 3 Immediate Term Improvements, and the Reduced Visibility Enhancement Project (DMS system). Maintenance is currently performed by existing DOTD staff or by City of Shreveport, and Bossier City maintenance staff through an existing contract maintenance agreement with DOTD. In the “Interim Phase,” system maintenance will be performed utilizing existing trained DOTD, City of Shreveport and Bossier City staff and/or contract maintenance agreements.

Figure 7.1 - Interim ITS Organizational Chart



During the “Interim Phase,” the MAP patrols will continue their current operation with staffing and personnel provided through the existing cooperative agreement with DOTD.

7.2.2 Near / Mid Term Organization and Staffing

When the RTMC is complete, a transition and consolidation of the DOTD District 04, City of Shreveport, and Bossier City Interim Traffic Management Operations to a single new facility will be implemented. This should coincide closely with the completion of the implementation of the Near-Term Phase 1 ITS Deployment along I-20. A proposed organizational chart for the Near to Mid Term Concept of Operations previously presented for the RTMC is shown in **Figure 7.2** and an organization structure for the Long Term Concept of Operations is shown in **Figure 7.3**.

Under the Near to Mid Term Concept of Operations, the ATMS Manager will be directly supported by an Operations and Maintenance (O & M) Supervisor for the Freeway and Incident Management Systems. The ATMS Manager will report directly to the District Administrator. The TMC Operations and Regional ITS Policy Committees will remain in place to dictate policy and procedures for operation. A full-time Operations and Maintenance supervisor for DOTD operations will be hired to handle the day-to-day operations of the RTMC including scheduling of ATMS operators and coordinating maintenance and incident response team activities. This will allow the ATMS Manager to focus on his/her primary responsibilities as previously described as the regional ITS system develops. Ultimately four ATMS operators will be required to operate 7 days per week through a.m. and p.m. peak periods. A full-time IT professional is recommended for network management, operating systems troubleshooting and systems maintenance. In addition, a public relations officer is also recommended to handle sensitive information dissemination to local media outlets, handle tours and educational requests and process newsletters and press releases. A motorist assistance patrol coordinator function is recommended to assist the O & M Supervisor with scheduling and coordinating day to day activities of the incident response team. Initially this may be performed through the existing Map Patrol contract by an ATMS operator. An office services/administrative assistant will also be required.

The cities of Shreveport and Bossier City will each house their Advanced Surface Street Control Operations at the RTMC. Each cities’ operation will require an O & M Supervisor and supporting traffic operators/technicians. The City Traffic Engineer and/or Supervisor will likely function as the O & M Supervisor. O & M Supervisors for Shreveport and Bossier City will coordinate directly with the DOTD ATMS Manager. The City of Shreveport and Bossier City will each require three traffic operators / technicians to operate the Advanced Surface Street Control Systems within their respective jurisdictions for the days and hours of operation previously discussed. The DOTD ATMS Manager will operate under the direction of the DOTD District 04 administrator who will work under the guidance of the TMC Operations and Regional ITS Policy Committees.

The City of Shreveport will control the operations of the Shreveport Advanced Surface Street Control Component of the regional ATMS consistent with the policies and procedures set forth

by the Regional ITS Policy Committee and the RTMC Operations Committee (both committees which the City of Shreveport will have significant representation).

Bossier City will control the operations of the Bossier City Advanced Surface Street Control component of the regional ATMS consistent with the policies and procedures set forth by the Regional ITS Policy Committee and RTMC Operations Committee (both committees which Bossier City will have significant representation).

Under the Long Term Concept of Operations, the City of Shreveport and Bossier City Surface Street Control Operations components would be consolidated under the direction of the Facility Administrator. The Freeway and Incident Management component personnel requirements would remain basically the same. Overall, all RTMC operating policies and procedures would still be governed by the Regional ITS Policy and RTMC Operating Committees, both which will have significant representation from both the City of Shreveport and Bossier City.

When the RTMC is initially open, it will be operated seven days a week; Monday through Friday from 6:00 a.m. to 7:00 p.m., with hours of operation during weekends 8:00 a.m. to 6:00 p.m. A concept for a staffing plan for the DOTD Freeway and Incident Management component is provided below. This staffing plan would require four ATMS operators with support from the Operations and Maintenance supervisors. Three full-time operators and one full- or part-time operator would be utilized. The following is the concept staffing and scheduling for the near-/mid-term operations assuming a seven-day a week operation covering a.m. and p.m. peak periods for the Freeway and Incident Management component.

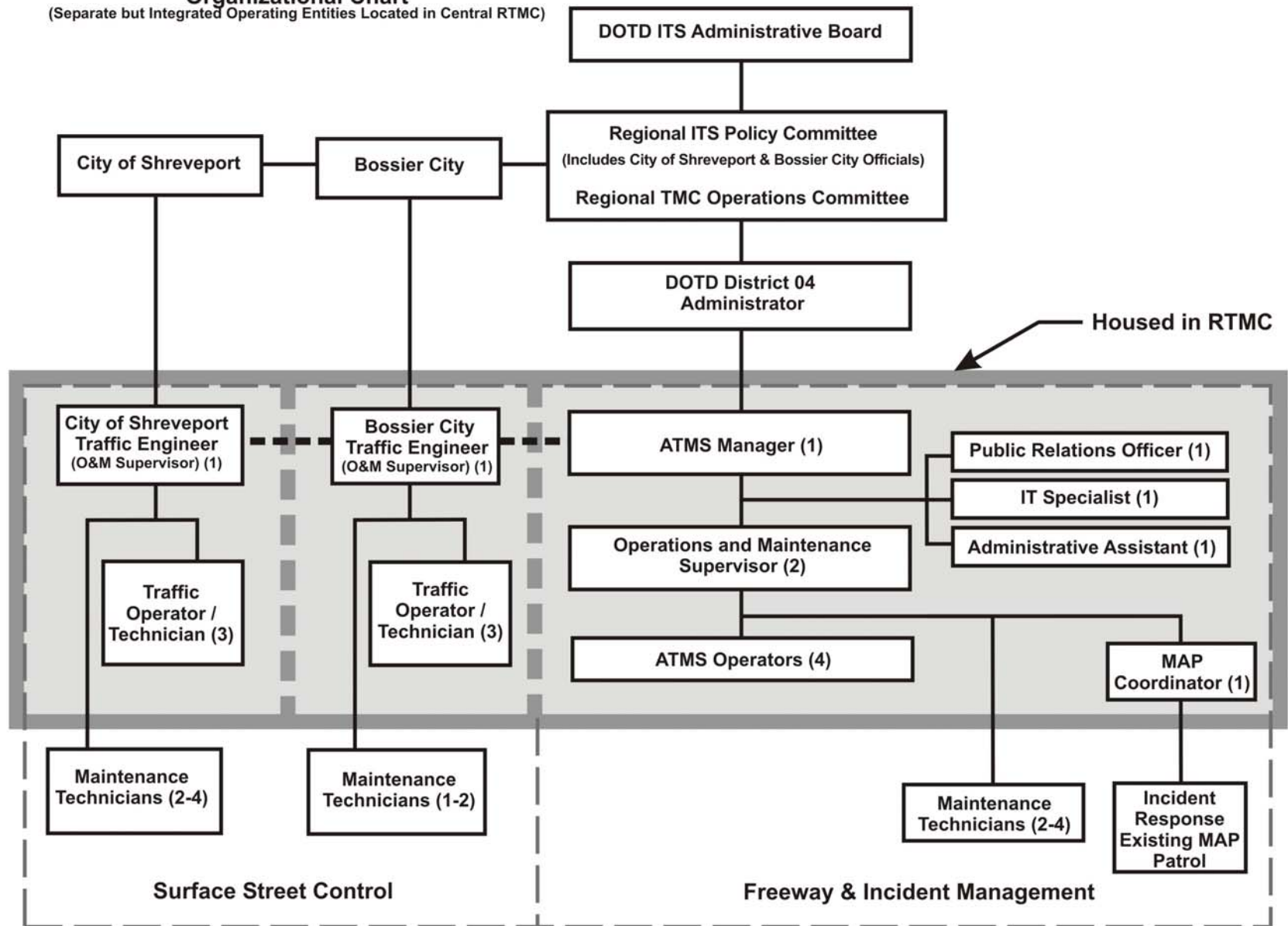
The full time ATMS operators would work four consecutive 8-hour days and have two days off with four day shifts beginning on alternate days to ensure that two persons are on duty during all hours of operation. This rotation repeats every six weeks with operators averaging approximately 40 hours per week.

Job Function	Days	Hours
ATMS operator #1	4 on, 2 off (days vary)	6:00 AM – 3:00 PM* ¹
ATMS operator #2	4 on, 2 off (days vary)	10:00 AM – 7:00 PM* ¹
ATMS operator #3	4 on, 2 off (days vary)	6:00 AM – 3:00 PM (2 days) * ¹ 10:00 AM – 7:00 PM (2 days) * ¹
ATMS operator #4 (Part Time)	M, T, W, TH, F	6:00 AM – 10:00 AM
O & M Supervisor 1	M, T, W, TH, F	6:00 AM – 3:00 PM
O & M Supervisor 2	M, T, W, TH, F	10:00 AM – 7:00 PM

*¹ Weekend shifts are 8:00 AM to 6:00 PM

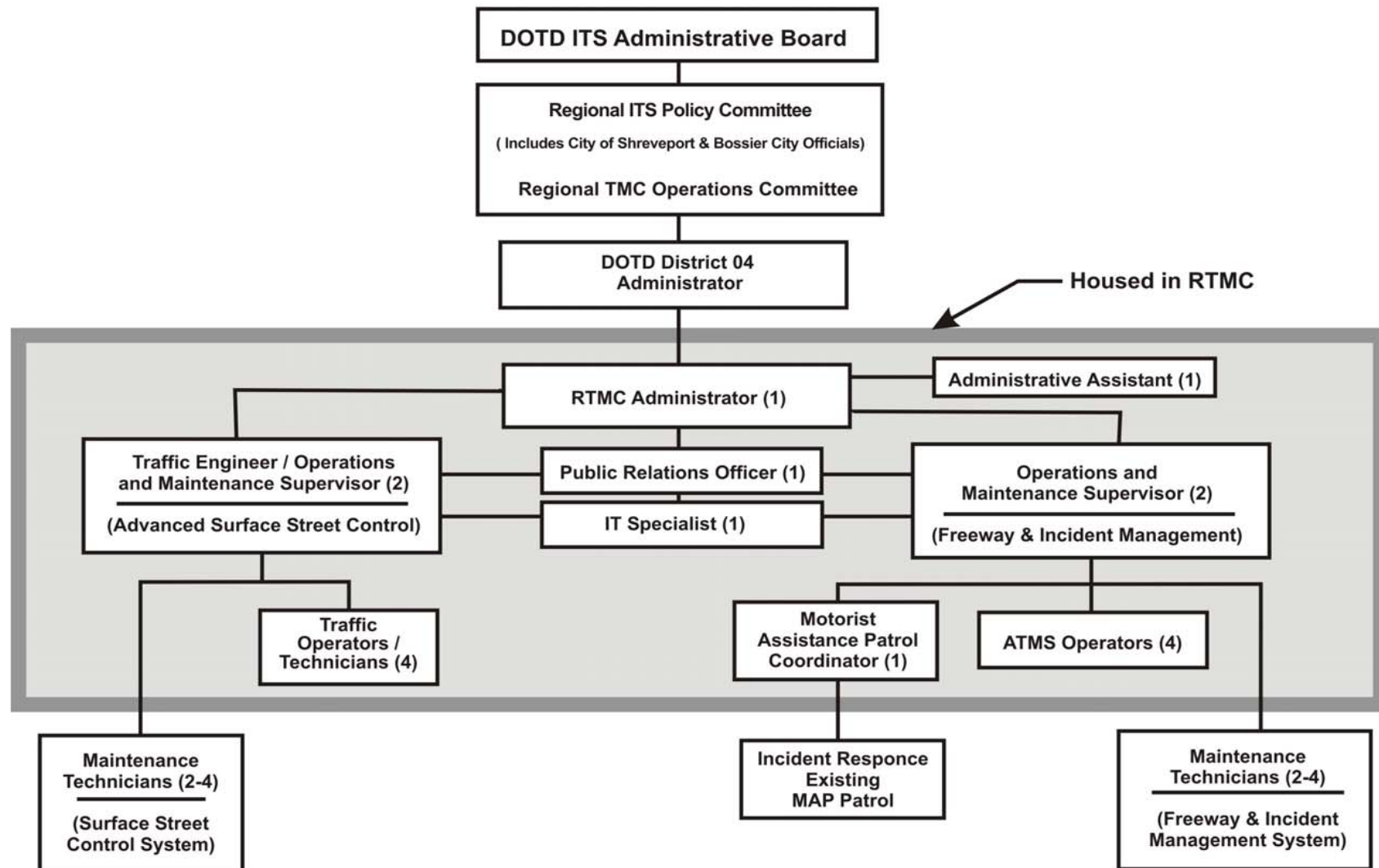
Figure 7.2 - Near to Mid Term Concept of Operations
Organizational Chart

(Separate but Integrated Operating Entities Located in Central RTMC)



**Figure 7.3 - Long Term Concept of Operations
Organizational Chart**

(Single operating entities, fully integrated and located in central RTMC)



This type of scheduling will assure two persons are working at all times during hours of operation. A similar staffing scheme would be required for the Surface Street Control Component with the City of Shreveport and Bossier City supplying adequate staffing. It is possible that the City of Shreveport can utilize existing engineering technicians to be trained as full-time operators.

The Operations and Maintenance Supervisor will oversee and coordinate maintenance functions. Maintenance service for the field deployed equipment associated with the Freeway and Incident Management System, and Roadway Weather Information Systems, as well as supporting hardware and software components at the RTMC will be performed by a combination of trained DOTD maintenance technicians and a contract maintenance service provider.

As previously noted, the City of Shreveport, Bossier City and DOTD do operate and maintain an extensive traffic signal control system for arterial streets within the region. Operations and maintenance of this system is performed by the City of Shreveport and Bossier City Traffic Engineering Divisions within their respective City Limits through an existing Operations and Maintenance Agreement with DOTD. DOTD maintains signal systems outside City jurisdictions. Both the DOTD and the Cities employ qualified staff and personnel to operate and maintain the Surface Street Control System. These personnel will continue to be utilized for such operations and maintenance and will be trained as necessary.

The Motorist Assistance Patrols (MAP) program is currently in place with adequate staffing and personnel provided through DOTD via a cooperative agreement. These services will continue through the “Near and Mid-Term Deployment” concurrent with existing interstate maintenance reconstruction projects. Once the reconstruction projects are complete, the services will continue through the long-term horizon, consistent with current DOTD policy, which allows continued operation of MAP Patrols with 50% DOTD funding and 50% local match.

7.2.3 Provisions for Training

The days and hours of operation along with required job descriptions, staffing and scheduling have been documented. The next issue to consider relative to staffing is training and preparing employees to operate the ATMS system. There are two key benefits relative to training by utilizing the phased implementation process noted within this document. This approach will allow initially for a simpler, less complex system in which inexperienced staff can more quickly be trained. This also allows initial staff to master the less complex system before beginning training for future more complex systems and operations.

The System Manager is typically responsible for design of the system, preparation of specifications, selecting off-the-shelf software, developing any on-site specific software, integration of the system, as well as providing training for staff relative to systems operation. For use of specialized firmware and off-the-shelf software, the manufacturer or developer will provide training and documentation via specific training requirements written into the specifications when necessary.

For the Shreveport/Bossier City regional ITS system, the System Manager (PB Farradyne Team) will work in close coordination with the RTMC Operations Committee to develop the Operating Guidelines for the ATMS System. The System Manager (in conjunction with suppliers and vendors) will be responsible for training staff in the operation of the system including use of site-specific and integration software. The System Manager will also provide documentation of site-specific and integration software for use by staff.

7.3 Funding Sources

7.3.1 System Funding

In order to implement the planned ITS program, adequate capital funding must be available for constructing and equipping the RTMC, for the deployment of the ITS field components of the ATMS, and for integration of the ITS systems. Adequate funding for operations and maintenance must also be available. DOTD in conjunction with NLCOG have identified the ITS Program as high priority and have secured and programmed substantial funding in the Transportation Improvement Program (TIP) for the planned deployment.

7.3.2 Current Funding for ITS Implementation

Capital funding presently programmed for the ITS Program in the Shreveport Bossier City metropolitan region includes the three following Federal Earmarks:

1. Shreveport/Bossier City Regional ITS Deployment (FY 2000) Earmark No. 1

Federal Share	(50%)	-	\$ 786,421
<u>Local/State Match</u>	<u>(50%)</u>	<u>-</u>	<u>\$ 786,421</u>
Total		-	\$ 1,572,842

2. Shreveport/Bossier City Regional ITS Deployment (FY 2001) Earmark No. 2

Federal Share	(50%)	-	\$ 795,364
<u>Local / State Match</u>	<u>(50%)</u>	<u>-</u>	<u>\$ 795,364</u>
Total		-	\$ 1,590,728

3. Shreveport/Bossier City Regional ITS Deployment (FY 2002) Earmark No. 3

Federal Share	(50%)	-	\$ 620,489
<u>Local / State Match</u>	<u>(50%)</u>	<u>-</u>	<u>\$ 620,489</u>
Total		-	\$ 1,240,978

The City of Shreveport also has \$5,000,000 in local funds programmed for ITS Surface Street Control Improvements within the City of Shreveport to match Federal Funding.

City of Shreveport ITS Program	-	\$ 5,000,000
Total available Capital Funding	-	<u>\$ 9,404,548</u>

Other Potential Funding Sources:

- 1) **Federal High Priority Funding** – Authorization of a new Federal Transportation Funding Program is pending in year 2003. Based on the High Priority Funding success of the region in the previous bill, and the high priority DOTD, NLCOG and local jurisdictions are placing on ITS deployment in the region, additional high-priority funding in the \$3 to 5 million range appears to be reasonable.
- 2) **Federal ITS Deployment Program Funding** – With the authorization of a new Federal Transportation Funding Program pending, and a comprehensive ITS Strategic Plan in place, the Shreveport/Bossier City region should be in a strong position to receive Federal ITS Deployment Program designations similar to the initial \$6.875 million appropriation the New Orleans region received in TEA-21. Based on this, \$4 to 6 million in Federal ITS Program funds can reasonably be anticipated over the next 10 years.
- 3) **Federal ITS Integration Funds** – The Shreveport/Bossier City metropolitan region has received \$4.4 million in ITS Integration funding over the last three years. Based on this, it is reasonable to assume that \$10 to 12 million in Federal ITS Integration funding over the 10-year horizon is possible.
- 4) **State ITS Program** – The State ITS Program is a \$10 million a year program currently. The Shreveport/Bossier City metropolitan region can reasonably expect to receive, on an average, \$1 – 2 million in funding annually. Based on this, funding of \$10 to 20 million over the 10-year horizon appears reasonable.

Based on these four potential reasonable funding sources, Federal and State Capital Funding Resources over the 10-year horizon appears to be in the \$27 to 43 million dollar range to implement the proposed ITS Program. This coupled with the existing \$9 million dollars currently in place and the potential for some additional local funding results in an estimated 10-year program between \$35 and \$55 million.

To make this program a reality, it is imperative the DOTD in conjunction with local Legislators and federal Legislators continue to aggressively pursue these funding sources. Annually the ITS priorities in the region should be assessed through DOTD and the NLCOG, projects prioritized and funding requests submitted and pursued at both the state and federal level.

SPORTRAN, the local transit authority also has a Planned ITS Program. The program includes Automatic Vehicle Location / CAD, and a Transit Management Center. SPORTRAN will work with FTA to secure funding for the transit component of the plan.

7.3.3 Operations and Maintenance Funding

In addition to capital funding, the Freeway and Incident Management / Roadway Weather Information System and Advanced Surface Street Control Program requires funding for operations and maintenance activities. As previously noted, DOTD in conjunction with the City of Shreveport, and Bossier City will operate and maintain the RTMC including the following:

- Maintain the physical structure (RTMC building).
- Share cost for power for operations of facility and equipment at the RTMC.
- Maintain hardware, software and other equipment located within the TMC.
- Provided necessary staffing for the operations of the RTMC.

DOTD will also provide funding for the operation and maintenance of ITS field equipment. DOTD will provide maintenance personnel and/or utilize a contract maintenance service provider for preventative maintenance and general maintenance repairs for ITS field deployed equipment within DOTD right-of-way including: ITS equipment and associated structures; environmental cabinet enclosures and controllers; the power distribution system and associated equipment not maintained by a private utility; and communication hubs, equipment, and any associated transmission system not maintained by a private utility. DOTD will also provide annual funding for power consumption of ITS field equipment within DOTD right-of-way and any communication leases required to operate ITS field-deployed equipment. As each phase of deployment is farther developed and design plans developed, an Operation and Maintenance Plan will be developed for each deployment phase.

The field devices associated with surface street control will continue to be maintained by the City of Shreveport and Bossier City via the existing contractual agreements with DOTD under the Near to Mid Term and Long Term Concept of Operations. If agreed to by all primary participants, a regional maintenance program could be investigated and considered in the Long Term Concept of Operations.

The NLCOG may consider utilizing >200 K Urban Funds to cover a percentage of O & M costs. Reasonable annual allocations at this point appear to be \$250,000 to \$300,000 if >200 K funding stays at current levels. The balance of funding for O & M services would come from DOTD, the City of Shreveport and Bossier City.

The Motorist Assistance Patrols will continue to operate along I-20, I-220, I-49 and LA 3132 in the metropolitan region consistent with the existing agreement in place with DOTD while the I-20 Interstate construction program continues into the foreseeable future. Upon completion of the Interstate Reconstruction Program, the NLCOG will enter into an agreement with DOTD, based on their current policy to continue the MAP Patrol through a 50/50 funding formula.

7.3.4 Estimate of Annual O & M Costs

The following is a listing of the preliminary estimated annual Operations and Maintenance costs by category consistent with staffing scenarios and concept of operations documented in this plan and consistent with the phasing shown in the Shreveport/Bossier City Metropolitan Region Planned ITS Deployment Schedule. (See *Section 3.4* for fiscally-constrained deployment schedule.)

Table 7.1 Projected O&M Costs for the Fiscally-Constrained ITS Deployment

Year	RTMC Staffing ⁽¹⁾	ITMC & RTMC Maintenance ⁽²⁾	Field Equipment O&M ⁽³⁾
2002	\$0	\$0	\$0
2003	\$0	\$0	\$0
2004	\$0	\$0	\$42,623
2005	\$0	\$24,000	\$495,099
2006	\$0	\$174,000	\$592,314
2007	\$180,000	\$237,000	\$653,424
2008	\$220,000	\$276,000	\$768,372
2009	\$320,000	\$276,000	\$951,495
2010	\$340,000	\$276,000	\$1,557,642
2011	\$400,000	\$276,000	\$1,918,518
2012	\$400,000	\$276,000	\$2,058,831
2013	\$400,000	\$276,000	\$2,261,100

- (1) O&M costs for RTMC staffing only (Interim TMC's to be staffed by existing personnel). Includes: base salary, overhead, overtime, and benefits. Contingency not included. Year 2002 dollars.
- (2) O&M costs for DOTD and Shreveport Interim TMC's, RTMC, and software/integration. Includes: maintenance of hardware, software, video projection devices, and general operating expenses such as office supplies. Assumes phase-out of Shreveport TMC after RTMC is fully-operational (after 2007). DOTD Interim TMC is retained for system back-up/redundancy purposes. Includes 20% contingency. Year 2002 dollars.
- (3) Includes maintenance of all system field equipment. For cost estimation purposes, Trunkline and Distribution Communications costs are included and assigned to selected deployment timeframes/phases as noted in *Section 3.4*. Includes 20% contingency. Year 2002 dollars.

NOTE: Estimates do not include costs for legacy systems that are operated and maintained using existing dedicated funding sources. See *Section 3.4* for discussion of fiscally-constrained deployment. Transit deployment not included.

8.0 REGIONAL TMC DESIGN GUIDELINES & CONCEPT PLAN

The Regional Transportation Management Center (RTMC) will be the center of operations and communications for the Shreveport / Bossier City ITS deployment network. This section focuses on the physical elements of the RTMC including the central control room, equipment and system requirements, communications, and the facility layout. The RTMC will house the regional ITS Command and Control Center, DOTD District 04 Traffic Engineering Services, City of Shreveport Traffic Engineering staff, as well as City of Bossier City traffic operators.

This RTMC and associated systems will be part of the Statewide ITS and will be linked to the other centers across Louisiana with remote operations capabilities. This facility will provide improvements to the management of both freeway and arterial traffic while creating an environment for complete access to all resources / information by all the participating agencies.

8.1 TMC Equipment

8.1.1 Direct Support Equipment

The communications equipment's spatial needs will vary greatly depending on equipment manufacturer and techniques of multiplexing. The following are some average spatial requirements for communications equipment:

PC based server	6U	*(1U = 1.75 inches in height)
Alpha class server	8U	
Communications chassis	5U	12-16 modems / 8 video channels
Multiplexing equipment	5U	varies greatly
Terminal servers	2U	up to 24 ports
Routers/hubs	2U	up to 24 ports
Fan units	2U	
Power Supplies	4U	
Radio equipment	5U	
Monitors	10U	
Keyboard trays	2U	
Video Switch (NTSC)	10U	20 x 200
Disk arrays	4U	hot swappable raid arrays

Equipment Racks

Two types of racks are the open frame rack and closed rack, both of which can come in a variety of heights and widths. The most common width of both of these racks is the 19" rack (larger widths are available, but not common). There are advantages to each type; the open rack is less

expensive, provides greater free airflow and can require less space (depending upon mounted equipment). The closed rack can provide greater protection for equipment and cabling, also provides cleaner and neater appearing equipment, also some pieces of equipment are required to be in a closed rack environment. The physical size of these racks are approximately 84" x 24" x 36" (H x W x D) for closed racks and 84" x 24" x 12" for an open rack. To quantify the useful space of a rack the standard 84" high rack is capable of holding 47U of equipment (1U = 1.75 inches), all rack mounted equipment will be referenced in this unit. The usable space will be about 90 % of the total rack space.

The physical floor space required per rack is 18 sq. ft. (6 for the rack and 6 each for front and rear access) some of the access space can be shared space with the rack or other equipment across the row from it.

8.1.2 Indirect Support Equipment

Direct support equipment includes the elements that provide interfaces the operators utilize to control the systems within the TMC. The interface allows the operators to see the overall systems performance on a large display system and intricate levels of detail at individual workstations.

As described below, there are three basic types of video display systems: 1) front projection; 2) CRT; and 3) rear projection.

Front Projection Systems

Require the most lighting control within the TMC and require additional equipment in the TMC. Personnel can interfere with the projection of the images. These units are typically a single projection unit and limit the number of pixels. These units typically require more routine maintenance than other types, an example would be convergence settings. Most of these units can project live NTSC images as well as computer-generated images.

CRT Systems

Require the least amount of lighting control in the TMC and the least amount of routine maintenance. It is not possible to display an image across multiple screens without losing or duplicating data. Single units cannot display NTSC video and computer generated images at the same time.

Rear Projection Systems

Require lighting control within the TMC and all projection equipment is in the equipment room. These system cubes can be stacked in a seamless fashion and a single image projected across multiple cubes. A disadvantage of these systems is degradation of the picture quality when viewed at a sharp angle (greater than 35 degrees typically). This viewing angle is specified on manufacturers cut sheets. The room design and the quality of the cubes purchased can minimize this constraint. The cubes can be aligned by row to optimize viewing. Most of these units can project live NTSC images as well as computer-generated images. Cube versions of rear

projection require about 3' of depth, open projection (non-cube) versions can require up to 9' of depth in to the utility room. The lighting in the equipment room will 'wash out' the images on an open rear projection system. This type of cube display system is recommended for TMC operation and a three cube high by five cube wide display wall will be assumed in this planning effort.

Placement

Optimal viewing distance is approximately 1 1/2 times the screen width, this should be taken into consideration when placing operator workstations within the TMC.

Viewers

Many TMC operators do not watch the display system for specific tasks, they have a monitor(s) located on their work surface. The display system will typically display system overview information that would not need to be replicated at all stations (example: system wide display map to indicate overall performance). Operators dealing with specific tasks tend to work from their individual monitor. Visitors are a factor in TMC design; the main impressions will come from the display system and overall aesthetics of the TMC. The equipment in the backroom will truly run the system but many visitors will never even go into the equipment room and those who do will typically leave a secondary impression.

Note when specifying a display system: not all display systems are compatible with the system hardware. This compatibility needs to be determined prior to specifying equipment. The operating strategies as well as the proposed images will determine the functional requirements of the display system.

The display systems have the requirement of a stable surface/platform for mounting.

Workstation Interfaces

Operators will have a multitude of equipment at there workstation. This equipment needs to allow the operator to obtain all needed information for their specific tasks. The workstations should be equipped with the following:

- Radio dispatch equipment
- Telephone equipment
- PC workstation(s)
- CCTV monitors

The operator may require more than one PC workstation. This is typically a function of the software integration and task level needs for efficient operation.

8.1.3 Power Requirements

Power Draw

The calculation of the power requirement should consider the following:

- Rack-mounted equipment requirements.
- Display system (e.g. 3 x 5 cube wall)
- Number of operator workstations

Other things to consider:

- While you will be maintaining operations off a UPS or generator you will need air-conditioning in the equipment room.
- If you have electronic security to the TMC you will need to maintain the same or provide personnel with means of bypassing the electronic security.
- The UPS and other power conditioning equipment can emit a 60-hertz hum and should be located to minimize any possible noise entering the TMC.
- The UPS should power the equipment in the TMC and any equipment needed to provide connectivity to the systems. This may include communications interface equipment in the buildings main communications center.
- Lighting during power outages is typically done off of generator power and includes most light fixtures.

8.1.4 HVAC Equipment

HVAC should be separate unit from the buildings central HVAC. This unit will need to be sized based on the BTU's generated by the equipment and personnel housed in the TMC and equipment room. This unit should be powered while equipment is powered. The TMC needs a separate control zone from the equipment room.

The Calculation for the heat generated by the equipment is expressed in the following formula: $\text{BTU/Hr} = 3.41 \times P$ - where BTU/Hr = air conditioner cooling capacity in British thermal units per hour. This does not account for the personnel located within the TMC.

8.2 Operational Requirements

8.2.1 Control Room Operations Personnel

The numerous functions and devices controlled by the TMC will require operators to be capable to handle multiple functions. Many of these functions will only utilize a fraction of the operator's time allowing for this multi-tasking capability. The operator time required by function is calculated based on typical usage. The amount of time devoted to any function can vary widely based on operational strategies and methodology.

In a multi-agency TMC environment there needs to be a representative for each agency or an agreement in place to allow operators of other agencies to interface with their equipment and personnel.

8.2.2 Control Room Supervision

The control room supervision can, and typically has, multiple levels. The first level identified is the lead operator position. The lead operator can be based on function as well as agency. An example of this would be a lead position for the signal systems, where multiple operators may utilize the signal systems, but the lead operator is responsible for the changes and updates.

The next level of supervision would be outside of the control room. This supervisor would be responsible for all functions within the control room on a per agency basis. The proximity to the control room is a key factor in the placement of this position. The ideal location allows this supervisor to have an office attached to the TMC with visual view of the display wall and operators. This office should also have an entrance separate from the TMC. The supervisor needs to have privacy in this office, blinds on the windows facing the TMC are recommended.

8.2.3 Control Room Workstations

This space requirement varies depending on duties. A typical operator space should include all communication needs and reference material at hand without leaving the operator station. There should be a common area to work with maps and plans. The base data indicates a great variety of equipment and a high level of multi-tasking for the operators. The assumptions for the workstation should be that each workstation shall be the primary location for the operator. The operator will have other factors to consider which are communications (radio, telephone, system LAN, agency LAN, etc.), reference material (operator/policy manuals, field equipment configuration tables, phone directories, maps), and contact with other operators and supervisor. The size suggested for the calculation of the spatial requirement is 80 square feet per operator.

8.3 TMC and Equipment Room Construction

8.3.1 Flooring

Raised flooring gives the most flexibility for the future by providing a large raceway for any cabling. Some sensitive cabling may be run through inner duct under this floor to provide additional protection. The raised floor method requires additional work if utilizing an open equipment rack which will require bolting to the floor not just to the raised floor tiles. The display systems cannot be placed on the raised flooring, it requires the stability of being mounted directly on the sub-flooring. One disadvantage of the raised floor is that there is an elevation difference from the remainder of the floor in the building. There can be a step up into the TMC or the slab floor can be depressed (new construction) to achieve a uniform elevation. This will eliminate ADA mitigation involving the stepping up onto the raised flooring.

Floor covering needs to be anti-static. This applies to both the TMC and the Equipment room. The equipment room is typically a tiled surface. The TMC is typically a carpeted surface.

8.3.2 Ceilings

The TMC ceilings are typically higher than normal ceilings due to the equipment in the TMC. The display systems can dictate the height of the ceiling in both the TMC and equipment rooms. An example, would be a display system consisting of a 3 high rear projection cube configuration requires 126 inches to the top of the display system (this would be 36 inches from floor and 3 cubes tall at 30 inches each).

8.3.3 Lighting

The TMC lighting within the control room should consider the general lighting effects on the display system(s), as well as task lighting for operators.

For general lighting, indirect and dimmable is the most common and preferred. There are dimmable fluorescence ballast available to serve this propose as well as incandescent. The control for dimming this lighting should be placed in reach of an operator station. Secondary controls (usually only on/off) should be placed at the room entrances. Remote control devices are available.

Task lighting should be dimmable and direct to the task area with consideration to potential glare on the display system and monitors. This lighting is typically incandescent contained in a deep recessed mounting with a non-reflective baffling. This lighting should have individual controls for a workstation or group of workstations. If the TMC equipped with overhead cabinets than under cabinet task lighting should be considered.

For the equipment room, standard fluorescent lighting will be sufficient. The placement should account for the equipment racks, which typically are seven feet high, can create shadowing. The work surface in the equipment room typically will need some supplemental lighting.

The lighting can be one of the most creative and dramatic affects within the TMC and should be given the proper consideration.

8.3.4 Layout Space

The Control room should contain surface to layout plans and maps that are needed by the operators. This can be a counter top on top of file drawers.

8.3.5 Soundproofing

The TMC control room should have sound damping materials on the floor and walls. The Control Room will have a great deal of communications occurring at any point in time these will include operator to operator, radio dispatching, telephonic, and in coming media sources. Soundproofing in the walls of equipment room can help to eliminate equipment noise into the TMC.

8.3.6 Maintenance / Repair Bench

A workbench in the equipment room is recommended for equipment troubleshooting and repairs. The space behind the workbench should allow movements past while someone is working at the bench.

8.3.7 Storage Area

Storage space is needed both in the TMC and in the equipment room. Equipment room storage requirements include storage for spare parts and test equipment. TMC storage shall include enough space for any needed operational manuals, operating supplies (paper, toner, etc.), reference books, files on field equipment configuration settings and maintenance records.

8.3.8 Connectivity

Physical connections (i.e. wiring, cabling) between the operator console(s) and equipment room is typically done under the floor. This can be accomplished in a few ways, one method is conduits under the floor between the console and equipment room. This method requires two conduits approximately 3-4" diameter to each console group. One will be used for power requirements including lighting controls, the other for communications. The second method is a raised floor, as described earlier this method is the most flexible. If there is no raised flooring, a ladder rack system is required to route communication cables between rows of equipment racks and communication conduits within the equipment room.

To reduce communication needs between the system and the console remote hubs to the system can be placed in the console(s).

The equipment room needs to have communication entrances. These can be shared with the

building resources or stand-alone entrances. If the media will include agency owned fiber, twisted pair or coax these should have a separate conduit out off the building (if new construction place some spare 3-4" conduits for future use). Radio communications may involve a conduit or path to the antenna on the roof. Communications to outside media sources should be addressed when planning (this would be incoming and outgoing).

8.3.9 Visitor / Observation Area

The TMC design needs to account for visitors. Typical TMC will get groups of visitors at a time as well as the individual visitors on a regular basis. These visitors vary greatly, they may be school children to colleagues and personnel that control the future funding. The TMC should accommodate these groups with providing standing room typically behind the operator stations when the space is available. A viewing area outside the TMC can provide an area to see the operation in action without disturbing the operators. The visitor's area outside of the TMC can be combined with a conference room with widows into the control room.

8.3.10 Sound System

The TMC should be equipped with a quality sound system. The sound system should be controlled from an operator station. The sound system should be able to deliver sound to a visitor area located outside of the control room. This sound system would be separate from the radio systems used by the operators. The radio systems used by the operator should utilize headsets as not to interfere with the other operators.

8.3.11 Security

The TMC should have adequate security to keep the casual visitor out. If there is a window(s) into the TMC blinds should be considered. The security system should provide an operator the ability to grant access with out leaving their workstation.

8.3.12 Electrical Equipment

A power operation plan needs to be created. This should include the methodology on the functions needing to be maintained, a plan of powering equipment long enough for a orderly shut down of non-critical functions.

The design of power distribution system to the equipment racks and workstations should include a topology that has the incoming power to the UPS and is then distributed through PDAs (power distribution assemblies). A typical PDA will power a pair of equipment racks or a workstation off of a single circuit breaker located in a electrical panel fed by UPS. Some PDAs contain internal breaker and can be fed directly from the UPS.

8.4 Schematic Program Requirements

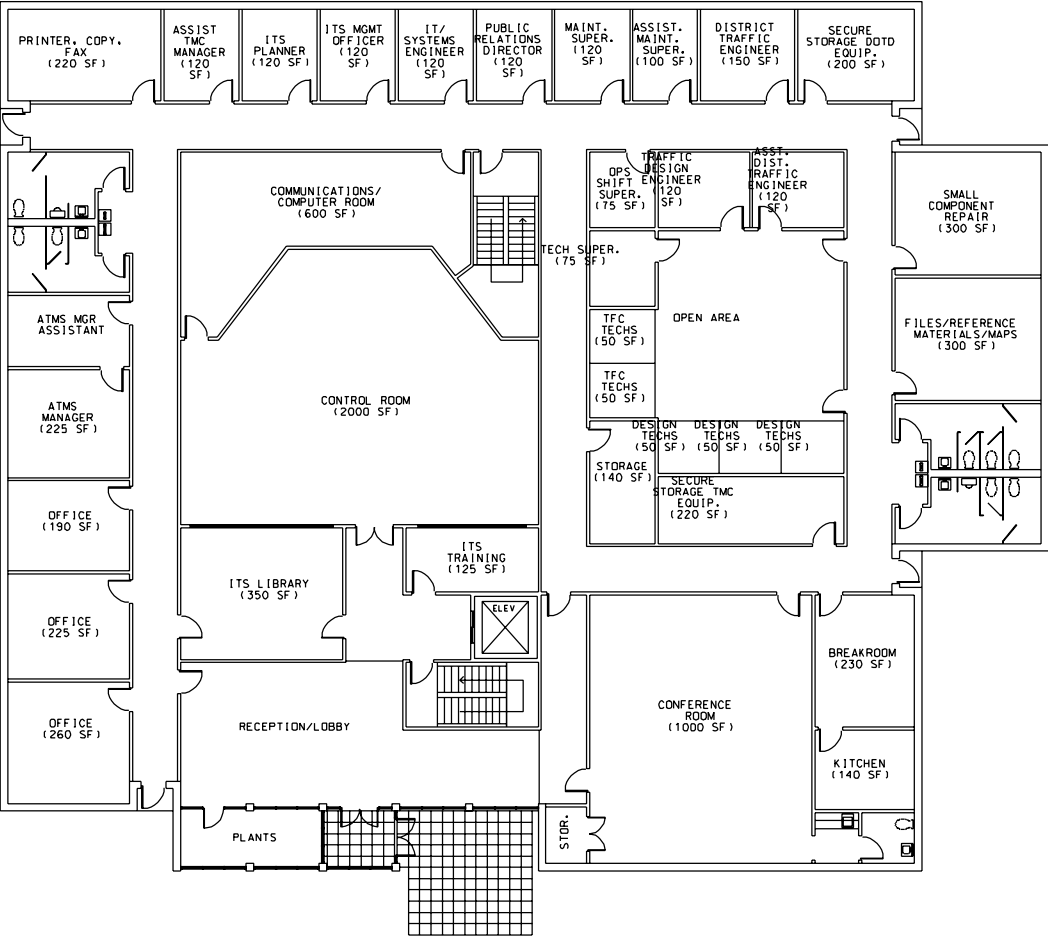
Table 8.1 contains the schematic program requirements for the Shreveport / Bossier City Regional TMC. Space estimates for the associated Regional Maintenance Facility are also shown. The preliminary Regional TMC floor plans illustrated in **Figure 8.1** help to illustrate the relationship of the spaces to each other.

Table 8.1 SCHEMATIC PROGRAM REQUIREMENTS

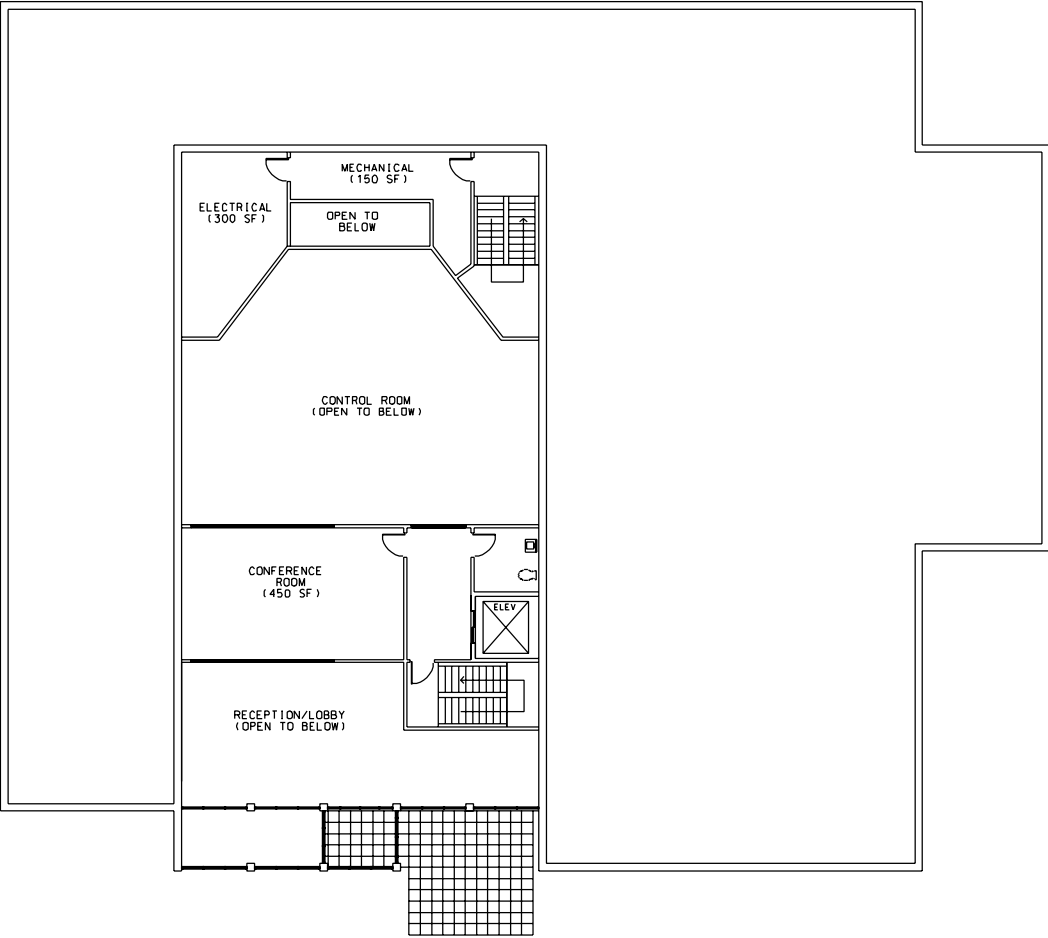
Program Elements	Space Estimate (Sq. Ft.)
1.) <u>Communications / Computer Room</u> – Servers, system servers (LAN), communication equipment, communication chassis, FDM, FOTI, video matrix, media racks, network management system	600 SF
2.) <u>Electrical Room</u> – Internal Telco communications, breaker panels, emergency switch gear for back-up generator	300 SF
3.) <u>Mechanical Room</u> – HVAC and other mechanical support equipment. (A back-up generator is also recommended. A secure exterior space (approximately 400SF) will be required to accommodate this feature)	150 SF
4.) <u>Storage</u>	
a.) <u>Normal Consumables</u> – Toiletries, light bulbs, cleaners, etc.	75 SF
b.) <u>Secure Storage</u> – TMC equipment, spare parts, batteries, toners, ribbons, circuit boards, bulk storage, cables, etc.	200 SF
c.) <u>Secure Storage</u> – For DOTD traffic services, traffic counters, tubes, spare parts for portable VMS.	200 SF
5.) <u>Small Component Equipment Repair Room</u> – For PCs, sensitive components, boards, modems, communication gear, and specialized tools.	300 SF
6.) <u>Printer, Xerox and Fax Room</u> – with layout/work space	240 SF
7.) <u>Control Room</u> – Workstations / consoles with PCs, monitors, communications, and video display (based on 9 consoles)	2,000 SF
8.) <u>File / Reference Material Room</u> – Storage of files, reference books, and operating manuals, for TMC & traffic services	300 SF
9.) <u>Conference Rooms</u>	
a.) <u>Large Conference Room</u> –for Regional Incident Management Meetings, Workshops, and Educational Seminars. Ability to partition off may be beneficial. (Assume 100 persons @ 20 SF/person plus service area)	1,000 SF
b.) <u>Small Conference Room</u> – For Executive level monitoring and management of emergency situations, with view of control room, media events, visitor and educational sessions.	450 SF
10.) <u>ITS Training Room</u> – (2 workstation capability) with view of control room	125 SF
11.) <u>Office Space</u>	
ATMS (Office Requirements)	

Table 8.1 SCHEMATIC PROGRAM REQUIREMENTS

Program Elements	Space Estimate (Sq. Ft.)
a.) ATMS Manager	225 SF
b.) ATMS Manager, Administrative Assistant	75 SF
c.) Assistant TMC Manager / Operations Supervisor	120 SF
d.) Operations Shift Supervisor	75 SF
e.) Maintenance Supervisor Office	120 SF
f.) Assistant Maintenance Supervisor	75 SF
g.) Electrical Technician (2 – 4)	@ testing & repair shop
h.) ITS Incident Management Officer	120 SF
i.) ITS Planner (1) (NWLCOG)	150 SF
j.) IT / Systems Engineer	120 SF
k.) Public Relations Director	120 SF
City of Shreveport Traffic Services (Office Requirements)	
a.) City Traffic Engineer (Private Office)	288 SF
b.) Traffic Engineer II (Private Office)	120 SF
c.) Management Assistant (2) (Private Office)	240 SF
d.) Analysts (3) (Open Plan Office)	360 SF
e.) Analyst File Room (Secure Access)	144 SF
12.) <u>ITS Library</u> (Reference Materials, Training Manuals, Equipment Manuals, etc.)	350 SF
13.) <u>Reception / Lobby Area</u> (To be determined by Architect)	-
14.) <u>Bathrooms</u> (To be determined by Architect)	-
15.) <u>Kitchen / Lounge / Break Room</u> (To be determined by Architect)	-
16.) <u>Circulation / Handicap Access / Stairwells / Elevator Shafts</u> (To be determined by Architect)	-
17.) <u>Parking</u> (To be determined by Architect)	-



RTMC – FIRST FLOOR PLAN
NOT TO SCALE



RTMC – SECOND FLOOR PLAN
NOT TO SCALE



Shreveport/Bossier City Regional ITS
Strategic Deployment Plan
Federal Aid Project No. SPR-9922(001)
State Project No. 700-99-0253



Figure 8.1
Preliminary Regional TMC Floor Plan

URS

PARSONS BRINCKERHOFF QUADE & DOUGLAS INC.

URS Project No. 04-00046316.02 | DATE: MAY 2002

9.0 ACTION PLAN

The Action Plan focuses on the Immediate-term and Near-term fiscally-constrained proposed ITS Deployment. It defines special actions that need to be taken to advance the DOTD ITS Deployment Program within the Shreveport / Bossier City region.

Action items can be divided into three categories:

1. Project Specific / Integration: Focuses on specific actions necessary to facilitate the timely deployment of high-priority deployment projects (see **Table 9.1**).
2. Interagency / Operations and Maintenance Agreements: Focuses on specific actions necessary to resolve institutional issues, implement the Regional ITS organizational structure, and develop operations and maintenance agreements. (See **Table 9.2**).
3. Funding: Focuses on actions necessary to pursue funding for future capital needs. (See **Table 9.3**).

Table 9.1 Necessary Actions: Project Specific / Integration

Proposed Deployment	Necessary Action
Immediate-Term Phase 1, 2 and 3 Deployment <ul style="list-style-type: none"> Signal System Improvements Communications interconnect DOTD Interim TMC Shreveport Interim TMC Communications System Software & Integration	<ol style="list-style-type: none"> URS prepare Scope and Fee estimate for Design Services (preparation of PS&E) not performed by DOTD in house. Execute Task Order for Design Perform pre-design scoping task Prepare Preliminary and Final Design PS&E
RTMC	<ol style="list-style-type: none"> Initiate planning task to refine schematic layout of TMC, site location, and facility planning Submit RTMC Plan to FHWA for verification of Federal participation Finalize funding program for RTMC Execute Memorandum of Understanding (MOU) between participating parties for RTMC Operations and Maintenance Initiate Task Order to perform Architectural services for RTMC Prepare Preliminary and Final PS&E

Table 9.2 Necessary Actions: Interagency / Operations & Maintenance Agreements

Project	Action
RTMC	<ol style="list-style-type: none"> Initiate detailed discussion regarding the level of participation and integration of other stakeholders into the Regional transportation management system, i.e. State Police, EMS 911, Shreveport Police, Bossier City Police, Caddo Parish Sheriff's Office, Bossier Sheriff's Office Prepare Draft MOU between DOTD, NLCOG, City of Shreveport, Bossier City and FHWA regarding the operations, maintenance and funding of the R TMC and transportation management system. Other stakeholders may be involved based on Item No. 1 Coordinate MOU among parties and execute Establish Regional ITS Policy Committee and TMC Operations Committee

Table 9.3 Necessary Actions: Funding

Project	Action
Regional Transportation Management System	<ol style="list-style-type: none"> Prepare and submit request for Federal funding of RTMC, Near-Term Phase 1 Deployment and signal system improvement for new transportation bill authorization Prepare and submit Integration Grant Applications for priority projects Provide prioritized list and project descriptions to NLCOG to pursue funding with local/regional delegation Prepare Grant application for FTA funding for SPORTRAN Transit ITS System

10.0 MEMORANDUM OF UNDERSTANDING

The following is an unexecuted draft Memorandum of Understanding (MOU) consistent with the provisions set forth in this document. It should be reviewed, modified as necessary, and executed between the primary parties involved in operations, maintenance and funding of the Regional ITS Deployment including:

- The Louisiana Department of Transportation and Development
- The Northwest Louisiana Council of Governments
- City of Shreveport
- City of Bossier City
- The US Department of Transportation/Federal Highway Administration

Memorandum of Understanding (Preliminary Draft Document)

MEMORANDUM OF UNDERSTANDING

FOR

STATE PROJECT NUMBER: _____

SHREVEPORT/BOSSIER CITY
REGIONAL TRAFIC MANAGEMENT CENTER

By and Among

THE CITY OF SHREVEPORT

and

BOSSIER CITY

and

**THE LOUISIANA DEPARTMENT OF TRANSPORTATION AND
DEVELOPMENT**

and

**THE U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION**

It is understood by all parties as follows:

I. Capital Outlay

- A. The Regional Transportation Management Center will be funded with a combination of Federal and State funds. The Louisiana Department of Transportation and Development (DOTD) will furnish the required matching funds.
- B. The field deployment of Intelligent Transportation Systems, Devices and Communications on the Interstate system will be funded with Federal and State funds. The DOTD will furnish the required matching funds.

- C. State and local Surface Street Control Systems (computerized signals), Intelligent Transportation Systems, Devices and Communications will be designed and constructed with a combination of Federal, State and local funds. All Signal Systems shall be NTCIP compliant if the NTCIP protocol is complete prior to final design, or NTCIP compatible if the protocol is not complete at that stage.

II. Implementation, Operations and Maintenance

- A. DOTD will be responsible for the design and implementation of the Freeway and Incident Management System and Roadway Information System on the Interstate system and other State routes identified in the ITS Strategic Plan including the design and implementation of Advanced Surface Street Control projects on State routes.
- B. DOTD will be responsible for the design and implementation of the Regional Transportation Management Center (RTMC), and will own the RTMC building.
- C. DOTD, the City of Shreveport and Bossier City will be responsible for the maintenance of the RTMC building including ITS related hardware, software and other equipment located within the RTMC. An agreement will be developed documenting each participating entities percentage of participation in the operating and maintenance costs such as power for operations of the facility and equipment at the RTMC.
- D. DOTD will provide necessary staffing for the operations of the Freeway and Incident Management component on the Interstate system for the regional deployment. The City of Shreveport and Bossier City will staff the operations of the Surface Street Control system in their respective jurisdictions.
- E. The DOTD will be responsible for maintenance of field ITS devices within DOTD right-of-way on the Interstate system, including power distribution and communications plant not owned and/or maintained by a private utility provider. DOTD will also be responsible for annual power usage expenses and associated communication leases, which may be required, associated with the Interstate deployment. The DOTD will provide trained in-house staff or contract personnel for maintenance services to maintain ITS field devices located within DOTD Interstate right-of-way. Provisions for spare parts and storage of spare parts will be accommodated by DOTD or through the contract maintenance service provider.
- F. The City of Shreveport Traffic Engineering Division currently operates and maintains signalized intersections (both City owned and DOTD owned) via an existing operation and maintenance agreement between DOTD and the City of Shreveport. The operation and maintenance of the planned computerized traffic signal system upgrades within the City of Shreveport will be inclusive in this

agreement. The city of Shreveport Advanced Surface Street Control improvements are outlined in the Strategic ITS Deployment Plan (*Section 3.0*).

- G. The City of Shreveport will be responsible for operating the Advanced Surface Street Control System within Shreveport. They will be responsible for providing personnel and staffing at the RTMC to operate the City of Shreveport Advanced Surface Street Control System.
- H. The City of Shreveport will participate in the maintenance costs at the RTMC attributable to their surface street control component i.e., cost of power, equipment maintenance, building maintenance, etc.
- I. The City of Bossier Traffic Engineering Division currently operates and maintains signalized intersections (both City owned and DOTD owned) via an existing operation and maintenance agreement between DOTD and Bossier City. The operation and maintenance of the planned computerized traffic signal system upgrades within Bossier City will be inclusive in this agreement. The Bossier City Advanced Surface Street Control improvements are outlined in the Strategic ITS Deployment Plan (*Section 3.0*).
- J. The City of Bossier will be responsible for operating the Advanced Surface Street Control System within Bossier City. They will be responsible for providing personnel and staffing at the RTMC to operate the Bossier City Advanced Surface Street Control System.
- K. Bossier City would participate in the maintenance costs at the RTMC attributable to their surface street control component i.e., cost of power, equipment maintenance, building maintenance, etc.
- L. Hours of Operation
 - During the “Interim Phase” the Interim TMC’s will operate five days per week (Monday through Friday) from 8:00 a.m. to 5:00 p.m. as a minimum.
 - During the “Near/Mid Term” deployment period, the RTMC will operate seven days per week with weekday operations from 6:00 a.m. to 7:00 p.m. and weekend operations from 8:00 a.m. to 6:00 p.m. as a minimum.

- The operations of the Motorist Assistance Patrol (MAP) shall be continued as presently established while Construction is under way in the area and shall be consistent with the operating hours of the RTMC when funded using Federal funds and State/local match.
- M. A Regional ITS Policy Committee will be established specific to the Shreveport/Bossier City metropolitan region. The District 04 Administrator will be responsible for coordinating and managing activities of this committee. This policy committee will be responsible for establishing and updating the regional ITS priority program through the TIP and addressing operational responsibilities and funding requirements for the RTMC. This committee will also be responsible for developing a process for resolving policy-level conflicts to ensure appropriate agency representation and voting strength that is compatible with each agency's financial commitment. The ITS Engineer Manager will consult with the Chief Engineer Office of Highways and Assistant Secretary Office of Operations in the event of critical policy-level conflicts. Committee members will include:
- DOTD District 04 Administrator (Chair) – Bruce Easterly
 - DOTD ITS Engineer Manager – Steve Glascock
 - Local Government Agency Representatives (2)
 - City of Shreveport appointee
 - Bossier City appointee
 - Metropolitan Planning Organization (MPO) Representative – Kent Rogers
 - Federal Highway Administration Representative – John Broemmelsiek
- N. A RTMC Operations Committee will also be established drawing on DOTD District and local government participation in a TMC environment, which will include the following personnel.
- TMC Facility Manager (Chair) – to be determined
 - DOTD District Traffic Operations Engineer – Keith Tindell
 - MPO – Kent Rogers and Wayne Gaither
 - State Police – Mark Oxley / Jim Mathews
 - City of Shreveport Police Department – Wayne Smith

- Bossier City Police Department – Ken Viola
- City of Shreveport – Mike Erlund
- City of Bossier City – Mark Hudson / John Kelly
- Bossier 911 – Tracy Hilburn

The TMC Operations Committee's responsibilities will be to identify and direct operational responsibilities of participating agencies in the TMC, resolve basic conflicts that do not require policy or executive level intervention, and oversee operational functions and integration maturity of the RTMC.

Witnesses:

_____	_____, Mayor City of Shreveport
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_____	_____ (Date)
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Witnesses:

_____	_____, Mayor City of Bossier City
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_____	_____ (Date)
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Witnesses:

_____	Kam K. Movassaghi, Ph.D., P.E., Secretary Department of Transportation & Development
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_____	_____ (Date)
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Witnesses:

_____	William A. Sussmann, Division Administrator Federal Highway Administration
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_____	_____ (Date)
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APPENDIX A

FHWA RULE AND FTA POLICY ON ITS ARCHITECTURE AND STANDARDS



Federal Register

Monday,
January 8, 2001

Part IV

Department of Transportation

Federal Highway Administration

23 CFR Parts 655 and 940
Intelligent Transportation System
Architecture and Standards; Final Rule

Federal Transit Administration

Federal Transit Administration National
ITS Architecture Policy on Transit
Projects; Notice

DEPARTMENT OF TRANSPORTATION

Federal Highway Administration

23 CFR Parts 655 and 940

[FHWA Docket No. FHWA-99-5899]

RIN 2125-AE65

Intelligent Transportation System Architecture and Standards

AGENCY: Federal Highway Administration (FHWA), DOT.

ACTION: Final rule.

SUMMARY: The purpose of this document is to issue a final rule to implement section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21), enacted on June 9, 1998, which required Intelligent Transportation System (ITS) projects funded through the highway trust fund to conform to the National ITS Architecture and applicable standards. Because it is highly unlikely that the entire National ITS Architecture would be fully implemented by any single metropolitan area or State, this rule requires that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a "regional ITS architecture." Therefore, conformance with the National ITS Architecture is defined under this rule as development of a regional ITS architecture within four years after the first ITS project advancing to final design, and the subsequent adherence of ITS projects to the regional ITS architecture. The regional ITS architecture is based on the National ITS Architecture and consist of several parts including the system functional requirements and information exchanges with planned and existing systems and subsystems and identification of applicable standards, and would be tailored to address the local situation and ITS investment needs.

EFFECTIVE DATE: February 7, 2001.

FOR FURTHER INFORMATION CONTACT: For technical information: Mr. Bob Rupert, (202) 366-2194, Office of Travel Management (HOTM-1) and Mr. Michael Freitas, (202) 366-9292, ITS Joint Program Office (HOIT-1). For legal information: Mr. Wilbert Baccus, Office of the Chief Counsel (HCC-32), (202) 366-1346, Federal Highway Administration, 400 Seventh Street, SW., Washington, DC 20590. Office hours are from 8 a.m. to 4:30 p.m., e.t., Monday through Friday, except Federal holidays.

SUPPLEMENTARY INFORMATION:

Electronic Access and Filing

You may submit or retrieve comments online through the Docket Management System (DMS) at: <http://dmses.dot.gov/submit>. Acceptable formats include: MS Word (versions 95 to 97), MS Word for Mac (versions 6 to 8), Rich Text Format (RTF), American Standard Code Information Interchange (ASCII) (TXT), Portable Document Format (PDF), and WordPerfect (version 7 to 8). The DMS is available 24 hours each day, 365 days each year. Electronic submission and retrieval help and guidelines are available under the help section of the web site.

An electronic copy of this document may be downloaded by using a computer, modem, and suitable communications software from the Government Printing Office's Electronic Bulletin Board Service at (202) 512-1661. Internet users may also reach the Office of the Federal Register's home page at <http://www.nara.gov/fedreg> and the Government Printing Office's web page at: <http://www.access.gpo.gov/nara>. The document may also be viewed at the DOT's ITS web page at <http://www.its.dot.gov>.

Background

A notice of proposed rulemaking (NPRM) concerning this rule was published at 65 FR 33994 on May 25, 2000, and an extension of the comment period to September 23, 2000, was published at 65 FR 45942 on July 26, 2000.

In the NPRM on this rule, the FHWA had proposed that the regional ITS architecture follow from the ITS integration strategy proposed in another NPRM entitled "Statewide Transportation Planning; Metropolitan Transportation Planning" published at 65 FR 33922 on May 25, 2000. That rule is being developed according to a different schedule and will be issued separately. For this reason, all references to the proposed integration strategy have been removed from this rule. However, it is still the intent of this rule that regional ITS architectures be based on established, collaborative transportation planning processes. The other major changes to the final rule relate to options for developing a regional ITS architecture and the time allowed to develop such an architecture. Additional changes to the final rule largely deal with clarification of terms, improved language dealing with staging and grandfathering issues, and clarification of use of ITS standards.

Intelligent Transportation Systems represent the application of information processing, communications

technologies, advanced control strategies, and electronics to the field of transportation. Information technology in general is most effective and cost beneficial when systems are integrated and interoperable. The greatest benefits in terms of safety, efficiency, and costs are realized when electronic systems are systematically integrated to form a whole in which information is shared with all and systems are interoperable.

In the transportation sector, successful ITS integration and interoperability require addressing two different and yet fundamental issues; that of technical and institutional integration. *Technical integration* of electronic systems is a complex issue that requires considerable up-front planning and meticulous execution for electronic information to be stored and accessed by various parts of a system. *Institutional integration* involves coordination between various agencies and jurisdictions to achieve seamless operations and/or interoperability.

In order to achieve effective institutional integration of systems, agencies and jurisdictions must agree on the benefits of ITS and the value of being part of an integrated system. They must agree on roles, responsibilities, and shared operational strategies. Finally, they must agree on standards and, in some cases, technologies and operating procedures to ensure interoperability. In some instances, there may be multiple standards that could be implemented for a single interface. In this case, agencies will need to agree on a common standard or agree to implement a technical translator that will allow dissimilar standards to interoperate. This coordination effort is a considerable task that will happen over time, not all at once. Transportation organizations, such as, transit properties, State and local transportation agencies, and metropolitan planning organizations must be fully committed to achieving institutional integration in order for integration to be successful. The transportation agencies must also coordinate with agencies for which transportation is a key, but not a primary part of their business, such as, emergency management and law enforcement agencies.

Successfully dealing with both the technical and institutional issues requires a high-level conceptual view of the future system and careful, comprehensive planning. The framework for the system is referred to as the *architecture*. The architecture defines the system components, key functions, the organizations involved, and the type of information shared

between organizations and parts of the system. The architecture is, therefore, fundamental to successful system implementation, integration, and interoperability.

Additional background information may be found in docket number FHWA-99-5899.

The National ITS Architecture

The Intermodal Surface Transportation Efficiency Act of 1991, Public Law 102-240, 105 Stat. 1914, initiated Federal funding for the ITS program. The program at that time was largely focused on research and development and operational tests of technologies. A key part of the program was the development of the National ITS Architecture. The National ITS Architecture provides a common structure for the design of ITS systems. The architecture defines the functions that could be performed to satisfy user requirements and how the various elements of the system might connect to share information. It is not a system design, nor is it a design concept. However, it does define the framework around which multiple design approaches can be developed, each one specifically tailored to meet the needs of the user, while maintaining the benefits of a common approach.

The National ITS Architecture, Version 3.0 can be obtained from the ITS Joint Program Office of the DOT in CD-ROM format and on the ITS web site <http://www.its.dot.gov>. The effort to develop a common national system architecture to guide the evolution of ITS in the United States over the next 20 years and beyond has been managed since September 1993 by the DOT. The National ITS Architecture describes in detail what types of interfaces should exist between ITS components and how they will exchange information and work together to deliver the given ITS user service requirements.

The National ITS Architecture and standards can be used to guide multi-level government and private-sector business planners in developing and deploying nationally compatible systems. By ensuring system compatibility, the DOT hopes to accelerate ITS integration nationwide and develop a strong, diverse marketplace for related products and services.

It is highly unlikely that the entire National ITS Architecture will be fully implemented by any single metropolitan area or State. For example, the National ITS Architecture contains information flows for an Automated Highway System that is unlikely to be part of most regional implementations.

However, the National ITS Architecture has considerable value as a framework for local governments in the development of regional ITS architectures by identifying the many functions and information sharing opportunities that may be desired. It can assist local governments with both of the key elements: technical interoperability and institutional coordination.

The National ITS Architecture, because it aids in the development of a high-level conceptual view of a future system, can assist local governments in identifying applications that will support their future transportation needs. From an institutional coordination perspective, the National ITS Architecture helps local transportation planners to identify other stakeholders who may need to be involved and to identify potential integration opportunities. From a technical interoperability perspective, the National ITS Architecture provides a logical and physical architecture and process specifications to guide the design of a system. The National ITS Architecture also identifies interfaces where standards may apply, further supporting interoperability.

Transportation Equity Act for the 21st Century

As noted above, section 5206(e) of the TEA-21, Public Law 105-178, 112 Stat. 457, requires ITS projects funded from the highway trust fund to conform to the National ITS Architecture, applicable or provisional standards, and protocols. One of the findings of Congress in section 5202 of the TEA-21, is that continued investment in systems integration is needed to accelerate the rate at which ITS is incorporated into the national surface transportation network. Two of the purposes of the ITS program, noted in section 5203(b) of the TEA-21, are to expedite the deployment and integration of ITS, and to improve regional cooperation and operations planning for effective ITS deployment. Use of the National ITS Architecture provides significant benefits to local transportation planners and deployers as follows:

1. The National ITS Architecture provides assistance with technical design. It saves considerable design time because physical and logical architectures are already defined.
2. Information flows and process specifications are defined in the National ITS Architecture, allowing local governments to accelerate the process of defining system functionality.
3. The architecture identifies standards that will support

interoperability now and into the future, but it leaves selection of technologies to local decisionmakers.

4. The architecture provides a sound engineering framework for integrating multiple applications and services in a region.

ITS Architecture and Standards NPRM Discussion of Comments

The FHWA received 105 comments on this docket from a wide range of stakeholders, including major industry associations, State departments of transportation, Metropolitan Planning Organizations (MPOs), and local agencies. The comments were generally favorable about the scope and content, but requested additional clarification and guidance on implementation of specific items. On many issues, some commenters wanted more specific requirements, while others wanted more flexibility. Most commenters, including major industry associations and public sector agencies, agreed with the overall scope, but some felt that the specifics might be difficult to implement and asked for clarification of key terms. A few commenters wanted the FHWA to reduce the number of requirements or convert the rulemaking into a guidance activity until more ITS deployment experience is gained.

In summary, the FHWA received a large number of generally favorable comments about the NPRM that suggested minor specific changes and expressed a need for further guidance on implementation. Since the general tenor of the comments was positive, the FHWA has kept the scope of the NPRM and made appropriate clarifications to the text of the final rule to address concerns raised in comments. In response to the many comments requesting it, starting in early 2001, the FHWA will also provide a program of guidance, training, and technical support to assist with the implementation of this rule. The following is a detailed discussion of the comments and their disposition, organized by subject matter.

Section 940.3 Definitions

ITS Project. There were 34 comments submitted to the docket concerning the definition of an ITS project. Many of the commenters felt the definition was not clear enough, was too broad, or was too subject to interpretation. Some comments questioned how much of a project's budget would have to be spent on ITS before a project would be considered an ITS project. Some suggested specific language to more narrowly define an ITS project by

focusing on the portion of the overall project that is actually ITS or by suggesting language that would narrow the definition of an ITS project to only include projects which introduce new or changed integration opportunities.

Since the intent of this rule and the supporting legislation is to facilitate the deployment of integrated ITS systems, it is the position of the FHWA that the definition of an ITS project must be fairly broad to include any ITS system being funded with highway trust fund dollars. It is only by properly considering all planned ITS investments in the development of a regional ITS architecture that the integration opportunities and needs can even be identified. This consideration should be carried out in the development of an architecture prior to the specific project being advanced. If, in the development of a regional ITS architecture, it is determined that a specific planned project offers no real integration opportunities for the region, then the impact of this rule on that specific project is minimal.

As a response to the comments concerning the clarity of the definition, the definition of an ITS project has been slightly modified to remove the examples since they were considered misleading. The FHWA recognizes that any definition will be subject to interpretation by the stakeholders and acknowledges the need for guidance in this area to ensure clear and consistent interpretation of this rule. Guidance on what constitutes an ITS project (including examples) will be developed to assist the various stakeholders, including the FHWA Division Offices, to better understand what projects should be considered ITS projects.

Region. There were 26 comments submitted related to the definition of a region. Seven comments supported the open definition provided in the NPRM, arguing that the possible integration opportunities in an area should define the region and that there were too many possible variations to allow a restrictive definition. Six commenters who expressed concern over varying conditions interpreted the definition to mean Metropolitan Planning Area (MPA). Five comments suggested an MPA was too restrictive. Eight other comments indicated that the proposed definition of a region did not clearly identify what entity would have the lead in developing a regional ITS architecture or thought the definition implied the MPO should have the lead. Nine comments suggested various limits or boundaries to fit specific situations. Ten comments expressed a need for

greater clarification of the definition for a region.

The intent of the proposed definition was to allow considerable flexibility on the part of the stakeholders in defining the boundaries of a region to best meet their identified integration opportunities. While there was no intent to generally restrict the definition to MPAs or States, the FHWA determined that regional ITS architectures should be based on an integration strategy that was developed by an MPO or State as part of its transportation planning process.

Given that the final rule does not require or reference an integration strategy, the FHWA feels a need to provide more specific guidance on the definition of a region. As such, the definition of a region has been revised to indicate that the MPA should be the minimum area considered when establishing the boundaries of a region for purposes of developing a regional ITS architecture within a metropolitan area. This should not be interpreted to mean that a region must be an MPA, or no less than an MPA, but the MPA and all the agencies and jurisdictions within the MPA should be at least considered for inclusion in the process of developing a regional ITS architecture within a metropolitan area. This rule is silent on other possible limits or minimum areas for defining a region, relying on the flexible nature of this rule to accommodate those special circumstances. The FHWA also acknowledges it is possible that overlapping regions could be defined and overlapping regional ITS architectures be developed to meet the needs of the regions.

Other Definitions. There were 20 comments suggesting that other terms used in the NPRM be defined. These included "interoperability," "standards," "concept of operations," "conceptual design," and "integration strategy." Several of these are no longer used in the final rule and, therefore, were not defined. Other terms, such as "interoperability" and "standards," were determined to be common terms whose definition did not effect the implementation of the final rule. Furthermore, language regarding standards conformity has been clarified in the body of the final rule.

Section 940.5 Policy

Twenty-eight commenters addressed the issue of consistency between the two related FHWA notices of proposed rulemaking (23 CFR parts 940 and 1410) and the Federal Transit Administration's (FTA) notice (FTA Docket No. FTA-99-6417) on National ITS Architecture published at 65 FR

34002 on May 25, 2000. The comments revealed a lack of understanding about the relationship between the regional ITS architecture and the integration strategy proposed as part of the revisions to FHWA's transportation planning rules. There were five comments suggesting a single DOT rule addressing how all ITS projects would meet the National ITS Architecture conformance requirements of the TEA-21 instead of an FHWA rule for highway projects and an FTA policy for transit projects. Four other comments acknowledged the need for two policies, but recommended they articulate the same process.

A final transportation planning rule is being developed on a different schedule than this rule, and comments regarding the portions of the National ITS Architecture conformity process included in the transportation planning rule will be addressed as it proceeds toward issuance. The FHWA and FTA have chosen to go forward with policies that have been developed cooperatively to implement the National ITS Architecture conformance process. This FHWA rule and the parallel FTA policy have been developed without reference to the proposed changes to the transportation planning process, including no mention of the development of an integration strategy. However, the policy statement of this rule notes a link to established transportation planning processes, as provided under 23 CFR part 450. This rule fully supports these collaborative methods for establishing transportation goals and objectives, and does not provide a mechanism for introducing projects outside of the transportation planning processes.

This final rule on National ITS Architecture conformance and the FTA policy on the same subject have been developed cooperatively and coordinated among the agencies to ensure compatible processes. Any differences between this rule and the parallel FTA policy are intended to address differences in highway and transit project development and the way the FHWA and the FTA administer projects and funds.

Fifteen commenters questioned the need for an integration strategy, and the relationship between the strategy and the regional ITS architecture.

Given the fact that proposed revisions to the FHWA's transportation planning rules are being developed according to a different schedule, this rule has been revised to remove any references to an integration strategy. Comments regarding the integration strategy will be addressed in the final transportation

planning rule, and the discussion of the regional ITS architecture in § 940.9 has been revised to clarify its content.

Section 940.7 Applicability

A few commenters noted that the proposed rule had not addressed the TEA-21 language that allows for the Secretary to authorize certain exceptions to the conformity provision. These exceptions relate to those projects designed to achieve specific research objectives or, if three stated criteria are met, to those intended to upgrade or expand an ITS system in existence on the date of enactment of the TEA-21. The legislation also included a general exemption for funds used strictly for operations and maintenance of an ITS system in existence on the date of enactment of the TEA-21.

The FHWA acknowledges this omission and has included the appropriate language in this section of the rule.

Section 940.9 Regional ITS Architecture

Several comments were received related to the way the proposed rule referred to developing regional ITS architectures. Eight comments, from State agencies and metropolitan planning organizations, supported an incremental approach to developing regional ITS architectures, starting with project ITS architectures and building them together. Four other comments, from metropolitan planning organizations and industry associations, noted that an ad hoc regional ITS architecture developed incrementally through projects would result in an architecture less robust than if there were a single, initial effort to develop it.

Also, thirteen comments from the Association of American State Highway and Transportation Officials (AASHTO) and a number of States recommended extending the time for developing regional ITS architectures, as the proposed two year implementation would be too short. Ten of the commenters preferred four years in order to acquire the necessary resources for developing regional ITS architectures.

Most commenters were in agreement with the content of the regional ITS architecture as defined in the proposed rule. However, there were 19 comments that dealt with confusion over the definition of both "conceptual design" and "concept of operations." In addition, there were 17 other comments on the makeup of the stakeholders, involvement of the private sector, and the need and desirability of "agreements" between stakeholders.

The comments indicated confusion regarding the development of regional ITS architectures, and especially so in discussing the period of time for their development. Therefore, the final rule has clarified the time period for developing regional ITS architectures by adopting the proposed extension to four years subsequent to beginning to deploy ITS projects (§ 940.9(c)), or four years from the effective date of this rule for those areas that are currently deploying ITS projects (§ 940.9(b)). In clarifying the time for development, this rule has eliminated any references to specific methods for developing regional ITS architectures. By not prescribing any methods, the rule provides flexibility to a region in deciding how it should develop its regional ITS architecture. Guidance and information related to developing regional ITS architectures is available from FHWA Division Offices and from the ITS web site, <http://www.its.dot.gov>, and will be expanded to provide assistance in meeting the intent of the rule.

Both the terms "conceptual design" and "concept of operations" have been deleted from the final rule. In their stead are descriptions of the content that is expected to form the basis for a regional ITS architecture. This content has not significantly changed from that defined in the NPRM but is now contained in § 940.9(d). The level of detail required is to the architecture flow level as defined in the National ITS Architecture. The regional ITS architecture must identify how agencies, modes, and systems will interact and operate if the architecture is to fulfill the objective of promoting ITS integration within a region.

The relevant stakeholders for a region will vary from region to region. The list articulated in § 940.9(a) is representative only and not meant to be inclusive or exclusive. On the specific issue of private sector participation, if the private sector is deploying ITS systems in a region or otherwise providing an ITS-based service, it would be appropriate to engage them in the development of a regional ITS architecture. Because of these variations from region to region, the FHWA felt it inappropriate to attempt to define an all inclusive list of stakeholders. The group of relevant stakeholders will be a function of how the region is defined and how transportation services are provided to the public. Section 940.9(d)(4) specifies that in the development of the regional ITS architecture, it shall include "any agreements (existing or new) required for operations." The formalization of these types of agreements is at the

discretion of the region and participating stakeholders.

There were 14 comments from a broad range of organizations questioning how existing regional ITS architectures, strategic plans or ITS Early Deployment Plans would be treated under this rule. It is the intent of the FHWA that any existing ITS planning documents should be used to the extent practical to meet the requirements of this rule. If a regional ITS architecture is in place, is up to date, and addresses all the requirements of a regional ITS architecture as described in this rule, there is no requirement to develop a "new" one. If the existing regional ITS architecture does not address all the requirements of the rule, it may be possible to update it so that it meets the regional ITS architecture requirements of this rule. What is necessary is that the end result is an architecture that meets the requirements of this rule and properly addresses the ITS deployments and integration opportunities of that region. This issue is specifically addressed in § 940.9(e) of this rule.

There were five comments related to the impact of this rule on legacy systems (*i.e.*, ITS systems already in place) and requesting some sort of "grandfathering" for them. The language in § 940.11(g) of the final rule clarifies the grandfathering or staging aspects of the process. The final rule does not require any changes or modifications to existing systems to conform to the National ITS Architecture. It is very likely that a regional ITS architecture developed by the local agencies and other stakeholders would call for changes to legacy systems over time to support desired integration. However, such changes would not be required by the FHWA; they would be agreed upon by the appropriate stakeholders as part of the development of the regional ITS architecture.

There were 15 comments dealing with the maintenance process and status of the National ITS Architecture. Two comments suggested the need for the FHWA to formally adopt the National ITS Architecture. Four other comments also supported the formalization of a process for maintaining or updating it with the full opportunity for public input.

Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a regional ITS architecture, and the subsequent adherence of all ITS projects to that regional ITS architecture. This rule requires that the National ITS Architecture be used as a resource in developing a regional ITS architecture.

As a technical resource, it is important that the National ITS Architecture be maintained and updated as necessary in response to user input or to add new user services, but formal adoption of the National ITS Architecture is not necessary. However, the FHWA recognizes the need to maintain the National ITS Architecture and to establish an open process for configuration control that includes public participation. The process currently used by the DOT to maintain the National ITS Architecture is very rigorous and involves significant public participation. That process is currently being reviewed by the DOT with the intent of establishing a configuration management process that engages the public at key stages and ensures a consensus for updating the National ITS Architecture.

Four comments suggested that this rule should not be implemented until the National ITS Architecture was complete. The National ITS Architecture will never stop evolving since there always is a potential need to regularly update it as more is learned about ITS deployment. The FHWA believes the National ITS Architecture is developed to a stage where it can be used as a resource in developing regional ITS architectures, as required by this rule.

Seventeen comments asked the FHWA to define the agency that is responsible for the development and maintenance of the regional ITS architecture; specifically MPOs and/or the State as those entities that are already responsible for the planning process.

The FHWA did not define the responsibility for either creating or maintaining the regional ITS architecture to a specific entity because of the diversity of transportation agencies and their roles across the country. It is recognized that in some regions traditional State and MPO boundaries may not meet the needs of the traveling public or the transportation community. This is also why the FHWA did not rigidly define a region. The FHWA encourages MPOs and States to include the development of their regional ITS architectures as part of their transportation planning processes. However, the decision is best left to the region to determine the approach that best reflects their needs, as indicated in § 940.9. It is clear that the value of a regional ITS architecture will only be realized if that architecture is maintained through time. However, in accepting Federal funds under title 23, U.S.C., the State is ultimately responsible for complying with Federal

requirements, as provided in 23 U.S.C. 106 and 133.

Four commenters noted that the proposed rule did not adequately address planning for, or committing to, a defined level of operations and maintenance.

The final rule addresses this concern on two primary levels, in the development of the regional ITS architecture and the development of individual projects. Section 940.9(d)(4) specifies that in the development of the regional ITS architecture, it shall include "any agreements (existing or new) required for operations." The formalization of these types of agreements is at the discretion of the region and participating stakeholders.

Also, relative to operations and management at a project level, § 940.11(c)(7) specifies that the systems engineering analysis (required of all ITS projects) includes "procedures and resources necessary for the operations and management of the system."

Section 940.11 Project Implementation

In addition to the comments on regional ITS architecture development noted above, the docket received 86 comments on systems engineering and project implementation. These comments revealed that the structure of the NPRM in discussing regional ITS architecture development, project systems engineering analysis, and project implementation was confusing and difficult to read.

To clarify these portions of the rule, the systems engineering and project implementation sections of the NPRM have been combined into § 940.11, Project Implementation. Also, paragraphs that were in the regional ITS architecture section of the NPRM that discussed major ITS projects and the requirements for developing project level ITS architectures have been rewritten to clarify their applicability. Since these paragraphs deal with project development issues, they have been moved to § 940.11(e). A definition for "project level ITS architecture" was added in § 940.3 and a description of its contents provided in § 940.11(e).

The docket received 33 comments regarding systems engineering and the systems engineering analysis section of the proposed rule. Most of the comments related to the definition, the process not being necessary except for very large projects, and confusion as to how these requirements relate to existing FHWA policy.

In response to the docket comments, the definition of systems engineering in § 940.3 has been clarified and is more consistent with accepted practice. In

order to provide consistency in the regional ITS architecture process, the systems engineering analysis detailed in §§ 940.11(a) through 940.11(c) must apply to all ITS projects regardless of size or budget. However, the analysis should be on a scale commensurate with project scope. To allow for the greatest flexibility at the State and local level, in § 940.11(c), a minimum number of elements have been clearly identified for inclusion in the systems engineering analysis. Many of those elements are currently required as provided in 23 CFR 655.409, which this rule replaces. Recognizing the change in some current practices this type of analysis will require, the FHWA intends to issue guidance, training, and technical support in early 2001 to help stakeholders meet the requirements of the final rule.

Fifty-three comments were submitted regarding ITS standards and interoperability tests. The commenters expressed concern about requiring the use of ITS standards and interoperability tests prematurely, the impact on legacy systems of requiring ITS standards, and confusion regarding the term "adopted by the DOT."

In response to the comments, the FHWA has significantly modified the final rule to eliminate reference to the use of standards and interoperability tests prior to adoption in § 940.11(f). Section 940.11(g) addresses the applicability of standards to legacy systems. It is not the intent of the DOT to formally adopt any standard before the standard is mature; and also, not all ITS standards should, or will, be formally adopted by the DOT. Formal adoption of a standard means that the DOT will go through the rulemaking process, including a period of public comment, for all standards that are considered candidates for adoption.

The DOT has developed a set of criteria to determine when a standard could be considered for formal adoption. These criteria include, at a minimum, the following elements:

1. The standard has been approved by a Standard Development Organization (SDO).
2. The standard has been successfully tested in real world applications as appropriate.
3. The standard has received some degree of acceptance by the community served by the standard.
4. Products exist to implement the standard.
5. There is adequate documentation to support the use of the standard.
6. There is training available in the use of the standard where applicable.

Therefore, the intent of the rule is to require the use of a standard only when these criteria have been met, and there has been a separate rulemaking on adoption of the standard.

The only interoperability tests that are currently contemplated by the DOT are those associated with the Commercial Vehicle Operations (CVO) program. These tests are currently being used by States deploying CVO systems and will follow a similar set of criteria for adoption as those defined for standards.

Section 940.13 Project Administration

There were nine comments related to how conformity with the final rule would be determined, and by whom. There were 11 comments about how conformity with the regional ITS architecture would be determined, and by whom. Six comments specifically suggested methods for determining conformance, including a process similar to current Federal planning oversight procedures. Six other commenters suggested that determination be made by the MPO or State. For either case, the comments reflected a lack of clarity as to what documentation would be necessary. There were six related comments suggesting the level of documentation be commensurate with the scale of the planned ITS investments in the region.

In § 940.13 of the final rule, the FHWA has attempted to clarify the process for determining conformance. Conformance of an ITS project with a regional ITS architecture shall be made prior to authorization of funding for project construction or implementation as provided in 23 U.S.C. 106 and 133. We do not intend to create new oversight procedures beyond those provided in 23 U.S.C. 106 and 133, but in those cases where oversight and approval for ITS projects is assumed by the State, the State will be responsible for ensuring compliance with this regulation and the FHWA's oversight will be through existing processes.

There were 14 comments concerning the documentation requirements of the proposed rule and generally suggesting they be reduced. Certainly the development of a regional ITS architecture and evidence of conformance of a specific project to that regional ITS architecture implies some level of documentation be developed. However, to allow flexibility on the part of the State or local agency in demonstrating compliance with the final rule, no specific documentation is required to be developed or submitted to the FHWA for review or approval. The FHWA recognizes the need to be able to scale the regional ITS

architecture and the associated documentation to the needs of the region. Section 940.9(a) of the final rule contains specific language allowing such scaling.

Summary of Requirements

I. The Regional ITS Architecture

This final rule on the ITS Architecture and Standards requires the development of a local implementation of the National ITS Architecture referred to as a regional ITS architecture. The regional ITS architecture is tailored to meet local needs, meaning that it does not address the entire National ITS Architecture and can also address services not included in the National ITS Architecture. The regional ITS architecture shall contain a description of the region and the identification of the participating agencies and other stakeholders; the roles and responsibilities of the participating agencies and other stakeholders; any agreements needed for operation; system functional requirements; interface requirements and information exchanges with planned and existing systems; identification of applicable standards; and the sequence of projects necessary for implementation. Any changes made in a project design that impact the regional ITS architecture shall be identified and the appropriate revisions made and agreed to in the regional ITS architecture.

Any region that is currently implementing ITS projects shall have a regional ITS architecture within four years of the effective date of this rule. All other regions not currently implementing ITS projects shall have a regional ITS architecture within four years of the first ITS project for that region advancing to final design. In this context, a region is a geographical area that is based on local needs for sharing information and coordinating operational strategies among multiple projects. A region can be specified at a metropolitan, Statewide, multi-State, or corridor level. Within a metropolitan area, the metropolitan planning area should be the minimum area that is considered when establishing the boundaries of a region for purposes of developing a regional ITS architecture. A regional approach promotes integration of transportation systems. The size of the region should reflect the breadth of the integration of transportation systems.

II. Project Development

Additionally, this rule requires that all ITS projects be developed using a systems engineering analysis. All ITS

projects that have not yet advanced to final design are required to conform to the system engineering requirements in § 940.11 upon the effective date of this rule. Any ITS project that has advanced to final design by the effective date of this rule is exempt from the requirements of § 940.11. When the regional ITS architecture is completed, project development will be based on the relevant portions of it which the project implements. Prior to completion of the regional ITS architecture, major ITS projects will develop project level ITS architectures that are coordinated with the development of the regional ITS architecture. ITS projects will be required to use applicable ITS standards and interoperability tests that have been officially adopted by the DOT. Where multiple standards exist, it will be the responsibility of the stakeholders to determine how best to achieve the interoperability they desire.

Rulemaking Analyses and Notices

Executive Order 12866 (Regulatory Planning and Review) and DOT Regulatory Policies and Procedures

The FHWA has determined that this action is not a significant regulatory action within the meaning of Executive Order 12866 or significant within the meaning of the Department of Transportation's regulatory policies and procedures. It is anticipated that the economic impact of this rulemaking will be minimal. This determination is based upon preliminary and final regulatory assessments prepared for this action that indicate that the annual impact of the rule will not exceed \$100 million nor will it adversely affect the economy, a sector of the economy, productivity, jobs, the environment, public health, safety, or State, local, or tribal governments. In addition, the agency has determined that these changes will not interfere with any action taken or planned by another agency and will not materially alter the budgetary impact of any entitlements, grants, user fees, or loan programs. Copies of the preliminary and final regulatory assessments are included in the docket.

Costs

The FHWA prepared a preliminary regulatory evaluation (PRE) for the NPRM and comments were solicited. That analysis estimated the total costs of this rule over 10 years to be between \$38.1 million and \$44.4 million (the net present value over 10 years was between \$22.3 million and \$31.2 million). The annual constant dollar impact was estimated to range between \$3.2 million and \$4.4 million. We believe that the

cost estimates as stated in the PRE are negligible. The FHWA received only one comment in response to the PRE. That commenter, the Capital District Transportation Committee of Albany, New York suggested that our cost estimates were too low, but provided no further detail or rationale which would cause us to reconsider or increase our cost estimates in the initial regulatory evaluation.

These 10-year cost estimates set forth in the PRE included transportation planning cost increases, to MPOs ranging from \$10.8 million to \$13.5 million, and to States from \$5.2 million to \$7.8 million associated with our initial requirement to develop an ITS integration strategy that was proposed as part of the metropolitan and statewide planning rulemaking effort. The agency now plans to advance that proposed ITS integration strategy in the planning rule on a different time schedule than this final rule. Thus, the costs originally set forth in the PRE for the ITS integration strategy have been eliminated from the final cost estimate in the final regulatory evaluation (FRE) for this rule.

In the FRE, the agency estimates the cost of this rule to be between \$1 million and \$16 million over ten years, which are the estimated costs of this rule to implementing agencies for the development of the regional ITS architectures. These costs do not include any potential additional implementation costs for individual projects which are expected to be minimal and were extremely difficult to estimate. Thus, the costs to the industry are less than that originally estimated in the agency's NPRM.

Benefits

In the PRE, the FHWA indicated that the non-monetary benefits derived from the proposed action included savings from the avoidance of duplicative development, reduced overall development time, and earlier detection of potential incompatibilities. We stated that, as with project implementation impacts, the benefits of the rule are very difficult to quantify in monetary terms. Thus, we estimated that the coordination guidance provided through implementation of the rule could provide savings of approximately \$150,000 to any potential entity seeking to comply with the requirements of section 5206(e) of the TEA-21 as compared with an entity having to undertake compliance individually. The costs may be offset by benefits derived from the reduction of duplicative deployments, reduced overall

development time, and earlier detection of potential incompatibilities.

In developing a final regulatory evaluation for this action, we did not denote a significant change in any of the benefits anticipated by this rule. This is so notwithstanding the fact that our planning costs for the ITS integration strategy have been eliminated from the final cost estimate. The primary benefits of this action that result from avoidance of duplicative development, reduced overall development time, and earlier detection of potential incompatibilities will remain the same.

In sum the agency believes that the option chosen in this action will be most effective at helping us to implement the requirements of section 5206(e) of the TEA-21. In developing the rule, the FHWA has sought to allow broad discretion to those entities impacted, in levels of response and approach that are appropriate to particular plans and projects, while conforming to the requirements of the TEA-21. The FHWA has considered the costs and benefits of effective implementation of ITS through careful and comprehensive planning. Based upon the information above, the agency anticipates that the economic impact associated with this rulemaking action is minimal and a full regulatory evaluation is not necessary.

Regulatory Flexibility Act

In compliance with the Regulatory Flexibility Act (5 U.S.C. 601-612), the FHWA has evaluated, through the regulatory assessment, the effects of this action on small entities and has determined that this action will not have a significant economic impact on a substantial number of small entities. Small businesses and small organizations are not subject to this rule, which applies to government entities only. Since § 940.9(a) of this rule provides for regional ITS architectures to be developed on a scale commensurate with the scope of ITS investment in the region, and § 940.11(b) provides for the ITS project systems engineering analysis to be on a scale commensurate with the project scope, compliance requirements will vary with the magnitude of the ITS requirements of the entity. Small, less complex ITS projects have correspondingly small compliance documentation requirements, thereby accommodating the interest of small government entities. Small entities, primarily transit agencies, are accommodated through these scaling provisions that impose only limited requirements on small ITS activities. For these reasons, the FHWA certifies

that this action will not have a significant impact on a substantial number of small entities.

Unfunded Mandates Reform Act of 1995

This action does not impose unfunded mandates as defined by the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4, March 22, 1995, 109 Stat. 48). This rule will not result in an expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of \$100 million or more in any one year.

Executive Order 13132 (Federalism)

This action has been analyzed in accordance with the principles and criteria contained in Executive Order 13132, dated August 4, 1999, and the FHWA has determined that this action does not have sufficient federalism implications to warrant the preparation of a federalism assessment. The FHWA has also determined that this action does not preempt any State law or State regulation or affect the State's ability to discharge traditional State governmental functions.

Executive Order 12372 (Intergovernmental Review)

Catalog of Federal Domestic Assistance Program Number 20.205, Highway planning and construction. The regulations implementing Executive Order 12372 regarding intergovernmental consultation on Federal programs and activities apply to this program.

Paperwork Reduction Act of 1995

This action does not contain information collection requirements for the purposes of the Paperwork Reduction Act of 1995, 44 U.S.C. 3501-3520.

Executive Order 12988 (Civil Justice Reform)

This action meets applicable standards in sections 3(a) and 3(b)(2) of Executive Order 12988, Civil Justice Reform, to minimize litigation, eliminate ambiguity, and reduce burden.

Executive Order 13045 (Protection of Children)

We have analyzed this action under Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This rule is not an economically significant rule and does not concern an environmental risk to health or safety that may disproportionately affect children.

Executive Order 12630 (Taking of Private Property)

This rule does not effect a taking of private property or otherwise have taking implications under Executive Order 12630, Government Actions and Interference with Constitutionally Protected Property Rights.

National Environmental Policy Act

The agency has analyzed this action for the purposes of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321-4347), and has determined that this action will not have any effect on the quality of the environment.

Regulation Identification Number

A regulation identification number (RIN) is assigned to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. The RIN contained in the heading of this document can be used to cross reference this proposed action with the Unified Agenda.

List of Subjects**23 CFR Part 655**

Design standards, Grant programs-transportation, Highways and roads, Incorporation by reference, Signs and symbols, Traffic regulations.

23 CFR Part 940

Design standards, Grant programs-transportation, Highways and roads, Intelligent transportation systems.

Issued on: January 2, 2001.

Kenneth R. Wykle,

Federal Highway Administrator.

In consideration of the foregoing, the FHWA amends Chapter I of title 23, Code of Federal Regulations, as set forth below:

PART 655—[AMENDED]

1. The authority citation for part 655 continues to read as follows:

Authority: 23 U.S.C. 101(a), 104, 109(d), 114(a), 217, 315, and 402(a); 23 CFR 1.32, and 49 CFR 1.48(b).

Subpart D—[Removed and reserved]

2. Remove and reserve subpart D of part 655, consisting of §§ 655.401, 655.403, 655.405, 655.407, 655.409, 655.411.

3. Add a new subchapter K, consisting of part 940, to read as follows:

Subchapter K—Intelligent Transportation Systems**PART 940—INTELLIGENT TRANSPORTATION SYSTEM ARCHITECTURE AND STANDARDS****Sec.**

940.1 Purpose.

940.3 Definitions.

940.5 Policy.

940.7 Applicability.

940.9 Regional ITS architecture.

940.11 Project implementation.

940.13 Project administration.

Authority: 23 U.S.C. 101, 106, 109, 133, 315, and 508; sec 5206(e), Public Law 105-178, 112 Stat. 457 (23 U.S.C. 502 note); and 49 CFR 1.48.

§ 940.1 Purpose.

This regulation provides policies and procedures for implementing section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21), Public Law 105-178, 112 Stat. 457, pertaining to conformance with the National Intelligent Transportation Systems Architecture and Standards.

§ 940.3 Definitions.

Intelligent Transportation System (ITS) means electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.

ITS project means any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National ITS Architecture.

Major ITS project means any ITS project that implements part of a regional ITS initiative that is multi-jurisdictional, multi-modal, or otherwise affects regional integration of ITS systems.

National ITS Architecture (also "national architecture") means a common framework for ITS interoperability. The National ITS Architecture comprises the logical architecture and physical architecture which satisfy a defined set of user services. The National ITS Architecture is maintained by the United States Department of Transportation (DOT) and is available on the DOT web site at <http://www.its.dot.gov>.

Project level ITS architecture is a framework that identifies the institutional agreement and technical integration necessary to interface a major ITS project with other ITS projects and systems.

Region is the geographical area that identifies the boundaries of the regional ITS architecture and is defined by and based on the needs of the participating agencies and other stakeholders. In metropolitan areas, a region should be no less than the boundaries of the metropolitan planning area.

Regional ITS architecture means a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects.

Systems engineering is a structured process for arriving at a final design of a system. The final design is selected from a number of alternatives that would accomplish the same objectives and considers the total life-cycle of the project including not only the technical merits of potential solutions but also the costs and relative value of alternatives.

§ 940.5 Policy.

ITS projects shall conform to the National ITS Architecture and standards in accordance with the requirements contained in this part. Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a regional ITS architecture, and the subsequent adherence of all ITS projects to that regional ITS architecture. Development of the regional ITS architecture should be consistent with the transportation planning process for Statewide and Metropolitan Transportation Planning.

§ 940.7 Applicability.

(a) All ITS projects that are funded in whole or in part with the highway trust fund, including those on the National Highway System (NHS) and on non-NHS facilities, are subject to these provisions.

(b) The Secretary may authorize exceptions for:

(1) Projects designed to achieve specific research objectives outlined in the National ITS Program Plan under section 5205 of the TEA-21, or the Surface Transportation Research and Development Strategic Plan developed under 23 U.S.C. 508; or

(2) The upgrade or expansion of an ITS system in existence on the date of enactment of the TEA-21, if the Secretary determines that the upgrade or expansion:

(i) Would not adversely affect the goals or purposes of Subtitle C (Intelligent Transportation Systems Act of 1998) of the TEA-21;

(ii) Is carried out before the end of the useful life of such system; and



Federal Register

Monday,
January 8, 2001

Part IV

Department of Transportation

Federal Highway Administration

23 CFR Parts 655 and 940
Intelligent Transportation System
Architecture and Standards; Final Rule

Federal Transit Administration

Federal Transit Administration National
ITS Architecture Policy on Transit
Projects; Notice

DEPARTMENT OF TRANSPORTATION**Federal Transit Administration****Federal Transit Administration
National ITS Architecture Policy on
Transit Projects**

AGENCY: Federal Transit Administration (FTA), DOT.

ACTION: Notice.

SUMMARY: The Federal Transit Administration (FTA) announces the FTA National ITS Architecture Policy on Transit Projects, which is defined in this document. The National ITS Architecture Policy is a product of statutory changes made by the Transportation Equity Act for the 21st Century (TEA-21) (Pub. L. 105-178) enacted on June 9, 1998. The National ITS Architecture Policy is also a product of the Request for Comment on the National ITS Architecture Consistency Policy for Project Development that was published in the *Federal Register* on May 25, 2000. Because it is highly unlikely that the entire National ITS Architecture would be fully implemented by any single metropolitan area or State, this policy requires that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a "regional ITS architecture." Therefore, conformance with the National ITS Architecture is defined under this policy as development of a regional ITS architecture within four years after the first ITS project advancing to final design, and the subsequent adherence of ITS projects to the regional ITS architecture. The regional ITS architecture is based on the National ITS Architecture and consists of several parts including the system functional requirements and information exchanges with planned and existing systems and subsystems and identification of applicable standards, and would be tailored to address the local situation and ITS investment needs.

DATE: *Effective Date:* This policy is effective from February 7, 2001.

ADDRESSES: For FTA staff, Federal Transit Administration, Department of Transportation (DOT), 400 Seventh Street, SW., Washington, DC 20590.

FOR FURTHER INFORMATION CONTACT: For *Technical Information:* Ron Boenau, Chief, Advanced Public Transportation Systems Division (TRI-11), at (202) 366-0195 or Brian Cronin, Advanced Public Transportation Systems Division (TRI-11), at (202) 366-8841. For *Legal Information:* Richard Wong, Office of

the Chief Council (202) 366-1936. The policy is posted on the FTA website on the Internet under <http://www.fta.dot.gov>.

Electronic Access: An electronic copy of this document may be downloaded using a computer, modem and suitable communications software from the Government Printing Office's Electronic Bulletin Board Service at (202) 512-1661. Internet users may reach the Office of the Federal Register's home page at: <http://www.nara.gov/fedreg> and the Government Printing Office's web page at: <http://www.access.gpo.gov/nara>.

Internet users may access all comments received by the U.S. DOT Dockets, Room PL-401, for the Request for Comment that was issued on May 25, 2000 which were used to clarify this Policy, by using the universal resource locator (URL): <http://dms.dot.gov>. It is available 24 hours each day, 365 days each year. Please follow the instructions online for more information and help. The docket number for the Request for Comment was FTA-99-6417.

SUPPLEMENTARY INFORMATION:**I. Background**

The Federal Transit Administration (FTA) published a Request for Comment on May 25, 2000, to implement section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21) (Pub. L. 105-178), which was enacted on June 9, 1998.

Section 5206(e) of TEA-21 requires that the Secretary of the DOT must

Ensure that intelligent transportation system projects carried out using funds made available from the Highway Trust Fund, * * * conform to the national architecture, applicable standards or provisional standards, and protocols developed under subsection(a).

The objectives for the FTA's National ITS Architecture Policy for Transit Projects are to:

- Provide requirements for ITS project development for projects implemented wholly or partially with highway trust funds.
- Achieve system integration of ITS projects funded through the highway trust fund with other transportation projects planned for the region, which will thereby enable electronic information and data sharing for advanced management and operations of the ITS infrastructure.
- Engage stakeholders (state DOT's, transit agencies, public safety agencies, other transportation operating agencies) in the project development and implementation process.
- Facilitate future expansion capability of the ITS infrastructure.

- Save design time through use of the National ITS Architecture requirements definitions and market packages.

FTA has developed this policy to meet the TEA-21 requirement contained in Section 5206(e) and the DOT/FTA goal to encourage effective deployment of ITS projects. Additionally, DOT and FTA encourage the coordination of local ITS strategies and projects to help meet national and local goals for mobility, accessibility, safety, security, economic growth and trade, and the environment.

The National ITS Architecture documents were developed by the US DOT, and are updated on an as-needed basis. Current work to update the National ITS Architecture is the Archive Data User Service, which provides the ability to store and process data over an extended period of time. FTA is pursuing the addition of a Rail ITS program for travel management, vehicles, and users. New versions of the documents, when they are issued, will be available from the US DOT on the DOT website at www.its.dot.gov. Version 3.0 is the latest version of the National ITS Architecture.

The first section of this policy contains a complete analysis of and response to the comments provided to the docket. The remainder of the Notice contains the FTA National ITS Architecture Policy for Transit Projects.

II. Public Comments

Eighteen comments were submitted to the FTA National ITS Architecture Consistency Policy for Project Development docket by the September 23, 2000, close of the comment period. Comments were submitted by transit operators (3), state and local governments (5), metropolitan planning organizations (4), industry associations (3), and consultants (3). As indicated earlier, a complete analysis and response to the docket comments is provided. In order to facilitate focused comments, FTA asked a series of questions about the policy. The public comment section is organized first by analysis and response to the specific questions asked; second by responses to comments not specifically related to one of the nine questions; and finally by an explanation of other changes. In general, the comments received were positive. Therefore, the FTA has kept the scope of the policy and made appropriate clarifications to the text of the policy to address concerns raised in comments. In response to the many comments requesting it, the FTA, in association with the ITS Joint Program Office, in the Federal Highway Administration (FHWA) will also provide a program of guidance, training, and technical

support to assist with the implementation of this policy.

Questions

1. Do reviewers understand the definition of a major ITS investment as defined in Section IV, "Regional ITS Architecture," or is more clarification needed, and if so please explain?

Comments: Nine commenters submitted responses to this question. In general, commenters found the definition confusing, and did not understand why major ITS projects need to be called out over other ITS projects. One commenter noted that small dollar projects can have a major impact on future development, while an expensive system may have no impact. Another commenter was unclear about the term "supporting national interoperability."

Response: Of specific concern to the agency is the timing in which requirements for this policy are enacted. As such, the terms "major ITS investment" and "major ITS project" were provided so as to distinguish between projects that will require immediate correlation to the regional ITS architecture and those that do not. The term "major ITS investment" was also found to be redundant to "major ITS project" and was removed from the policy. Guidance on the classification of "ITS projects" and "major ITS projects" will be provided upon enactment of the policy.

2. Do reviewers understand the definition of an ITS project, or is more clarification needed, and if so please explain?

Comments: Nine commenters submitted responses to this question. Commenters found this term less confusing than "major ITS investments," but requested more clarification. Some commenters proposed alternative language or asked for clarification on particular examples.

Response: The agency has clarified the definition by deleting the potentially ambiguous examples provided and will develop guidance material that provides examples of projects that will be considered ITS projects and those that will not be considered ITS projects. In general, unless a technology project is implementing one of the ITS user services defined in the National ITS Architecture, it would not be considered an ITS project.

3. Do reviewers understand the difference between a "major ITS investment," and an "ITS project," or is more clarification needed, and if so please explain?

Comments: Eight commenters submitted responses to this question. Commenters had mixed responses, as

some commenters found the differences to be clear, while others requested that guidance material be provided to further explain the differences. Commenters did suggest that a "project" is a "project" and should not be quantified in terms of dollar amounts.

Response: As described in the response to question 1, the agency has removed the term "major ITS investment" and will provide guidance on the term "ITS project."

4. Are the requirements for development of a Regional ITS Architecture clear? If not, what is not clear about the requirement?

Comment: Nine commenters provided responses to the question. Most commenters found the requirements to be unclear and/or did not agree with the requirements. One commenter suggested that a region will have different definitions. One commenter noted that a concept of operations and conceptual design are normally conducted at the project level. One commenter requested clarification as to the appropriate place to program projects, in the regional ITS architecture, or in the planning process.

Response: Of specific concern to the agency is providing a flexible policy that allows the transportation stakeholders to define their region and the roles and responsibilities of each stakeholder during the development of a regional ITS architecture. As such, the agency has clarified the requirements of a regional ITS architecture and also removed the specific requirements for a Concept of Operations and a Conceptual Design. Instead, the agency has listed the specific requirements for a regional ITS architecture and has left the development, documentation, and maintenance of the regional ITS architecture to the stakeholders involved. Also, the region is defined as "a geographical area that is based on local needs for sharing information and coordinating operational strategies among multiple projects." A region can be specified at a metropolitan, Statewide, multi-State, or corridor level. Additional guidance on this topic will be provided after enactment of the policy.

5. What additional guidance, if any, is required to explain how to implement this proposed policy?

Comments: Ten commenters provided responses to this question. All the comments called for additional guidance on the specifics of implementing this policy. Commenters requested guidance on the definition of a "region," the ownership of the regional ITS architecture, determination of stakeholders, regional ITS architecture maintenance, certification

and simplification of definitions. One commenter requested that the policy be limited to only the ITS Integration Requirements defined in the Metropolitan and Statewide Planning NPRM.

Response: The agency will provide guidance materials to address the comments suggested. The ITS Integration Strategy, as defined in the NPRM, is part of the planning process and as such does not satisfactorily address project level requirements.

6. The proposed rule allows regions to develop a Regional Architecture as a separate activity, or incrementally, as major ITS investments are developed within a region. Do reviewers anticipate particular difficulties with implementing and documenting either approach?

Comments: Nine commenters provided responses to this question. Commenters largely did not favor one approach over the other. One commenter suggested that a regional ITS architecture with a twenty year time horizon is impractical and infeasible. One commenter suggested that either approach would require additional staff resources.

Response: The agency was concerned about the time horizon and development process needed to create a regional ITS architecture within the time period required and as a result suggested both an incremental and initial comprehensive approach. Based on the responses, the agency has modified the policy to be silent on the approach used to develop the regional ITS architecture. Instead, the agency focused on the products included in the regional ITS architecture, the effective date of the requirements, and the catalyst for requiring the development of a regional ITS architecture.

7. Do reviewers understand the relationships between the Integration Strategy, the Regional ITS Architecture, and the ITS Project Architecture?

Comment: Seven commenters provided a response to this question. In general, commenters did not understand the relationship between the Integration Strategy, regional ITS architecture, and the ITS Project Architecture. One commenter suggested that flexibility in application of project architecture must be maintained to accommodate legacy systems and to take advantage of technological innovation, while maintaining the outcome of interoperability, where applicable.

Response: The Agency is concerned with linkage between the planning process and the project development process. However, this policy only deals with the project level requirements.

Planning level requirements, including the Integration Strategy, will be explained as the Metropolitan and Statewide Planning Process rulemaking process is advanced. This policy only requires that the regional ITS architecture should be consistent with the transportation planning process. A definition for a project level ITS architecture has been added to the policy.

8. What additional guidance, if any, is required regarding phasing of this rule?

Comments: Six commenters submitted responses to this question. In general, the commenters stated that the phasing was clear. However, one commenter requested a three-year phase-in period. Several commenters requested that existing projects be exempt from the policy.

Response: The agency has clarified the policy statements that refer to the project status and the applicability of this policy. Projects that have reached final design by the date of this policy are exempt from the policy requirements. The agency has extended the time period for regional ITS architecture development to four years. Any region that is currently implementing ITS projects shall have a regional architecture within four years of the effective date of the final policy. All other regions not currently implementing ITS projects shall have a regional ITS architecture in place within four years of the first ITS project for that region advancing to final design.

9. Are the oversight and documentation requirements clear? If not, what is not clear about the requirements?

Comments: Eight commenters submitted responses to this question. Commenters in general requested more guidance from FTA on oversight and documentation requirements, but few provided suggestions to clarify the requirements. One commenter suggested that checklists to verify consistency requirements will be needed. Other commenters suggested that self-certification should be allowed, but also needs to be clearly defined.

Response: The agency will continue to use normal existing oversight procedures to review grantee compliance with FTA policies and regulations. Normal oversight procedures include the annual risk assessment of grantees performed by regional office staff, triennial reviews, planning process reviews, and project management oversight reviews, as applicable. In TEA-21, FTA was granted authority to use oversight funds to provide technical assistance to grantees in which oversight activities suggested

non-compliance with agency policies and regulations. FTA is using oversight funds to specifically hire contractors with ITS experience who will monitor and assist grantees who are at risk of NOT meeting the National ITS Architecture Policy requirements. Additional guidance on oversight and documentation requirements will be provided.

Additional Comments

One commenter suggested that the proposed guidance circular requires that all of the agencies in a region agree before a project can be implemented, thus conferring "veto" power over the project. The agency does not intend for the policy to halt ITS deployment in areas where agencies cannot agree on project designs. As part of the regional ITS Architecture development, the agencies can agree to disagree, however, the regional ITS architecture should include a representation of the stand-alone ITS deployments.

One commenter suggests that the proposal infers that existing agreements between agencies will now need to be amended or redone, which would result in a halt in operations of successful ITS projects and prevent the completion of other ITS projects. In response to the comment, the agency has clarified the regional ITS architecture requirements to specify that existing agreements that address the regional ITS architecture requirements are sufficient and that new agreements are not necessarily required.

One commenter noted that a definition of ITS was not included in the policy. The commenter suggested that the definition provided in TEA-21 section 5206(e) should be included in the policy. The agency agrees and has added the definition of ITS to the list of definitions. However, the legislative definition of ITS is broad and other commenters have suggested that if the policy is written to include every new piece of electronics or hardware, then the policy would be too limiting. As a result, the policy is intended to apply only to projects meeting the definition of an "ITS project" listed in the "Definitions" section of the policy.

One commenter suggested that DOT should ensure that the Federal Highway Administration's (FHWA's) regulation and the FTA policy have the same statutory standing and that their requirements in ITS planning and deployment be consistent if not identical. The FTA and FHWA have different processes and procedures for project development. Therefore, the FHWA has issued a regulation, and FTA has issued the policy. The policy language in each document is consistent

and will be carried out in a coordinated fashion, as applicable under FTA and FHWA project management and oversight procedures. FTA and FHWA planning procedures are a joint regulation and as such will be identical.

FTA received some comments regarding the use of standards. Several comments concern the premature use of required standards and interoperability tests, their impact on legacy systems, and confusion regarding the term "adopted by the USDOT."

In response to the comments, FTA has significantly modified the final policy to eliminate reference to the use of standards and interoperability tests prior to adoption through formal rulemaking. It is not the intent of the USDOT to formally adopt any standard before the standard is mature; also, not all ITS standards should, or will, be formally adopted by the USDOT. The only interoperability tests that are currently contemplated by the USDOT are those associated with the Commercial Vehicle Operations (CVO) program. These tests are currently being used by States deploying CVO systems and will follow a similar set of criteria for adoption as those defined for standards.

Other Changes

Several commenters expressed concern about linkages to the planning rule and the integration strategy. Comments regarding the portions of the National ITS Architecture conformity process included in the proposed transportation planning rule will be addressed as that rule proceeds to its issuance. The FHWA rule and the parallel FTA policy have been developed without direct reference to the proposed changes to the transportation planning process, including no mention of the development of an integration strategy. However, the policy statement of this guidance notes a link to transportation planning processes, and fully supports those collaborative methods for establishing transportation goals and objectives.

Policy Contents

- I. Purpose
- II. Definitions
- III. Policy
- IV. Applicability
- V. Regional ITS Architecture
- VI. Project Implementation
- VII. Project Oversight
- VIII. FTA Guidance

I. Purpose

This policy provides procedures for implementing section 5206(e) of the Transportation Equity Act for the 21st

Century, Public Law 105-178, 112 Stat. 547, pertaining to conformance with the National Intelligent Transportation Systems Architecture and Standards.

II. Definitions

Intelligent Transportation Systems (ITS) means electronics, communications or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.

ITS project means any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National ITS Architecture.

Major ITS project means any ITS project that implements part of a regional ITS initiative that is multi-jurisdictional, multi-modal, or otherwise affects regional integration of ITS systems.

National ITS Architecture (also "national architecture") means a common framework for ITS interoperability. The National ITS Architecture comprises the logical architecture and physical architecture which satisfy a defined set of user services. The National ITS Architecture is maintained by U.S. DOT (Department of Transportation) and is available on the DOT web site at <http://www.its.dot.gov>.

Project level ITS architecture is a framework that identifies the institutional agreement and technical integration necessary to interface a major ITS project with other ITS projects and systems.

Region is the geographical area that identifies the boundaries of the regional ITS architecture and is defined by and based on the needs of the participating agencies and other stakeholders. A region can be specified at a metropolitan, Statewide, multi-State, or corridor level. In metropolitan areas, a region should be no less than the boundaries of the metropolitan planning area.

Regional ITS architecture means a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects.

Systems engineering is a structured process for arriving at a final design of a system. The final design is selected from a number of alternatives that would accomplish the same objectives and considers the total life-cycle of the project including not only the technical

merits of potential solutions but also the costs and relative value of alternatives.

III. Policy

ITS projects shall conform to the National ITS Architecture and standards in accordance with the requirements contained in this part. Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a regional ITS architecture in support of integration and the subsequent adherence of all ITS projects to that regional ITS architecture. Development of the regional ITS architecture should be consistent with the transportation planning process for Statewide and Metropolitan Transportation Planning (49 CFR part 613 and 621).

IV. Applicability

(a) All ITS projects that are funded in whole or in part with the Highway Trust Fund (including the mass transit account) are subject to these provisions.

(b) The Secretary may authorize exceptions for:

1. Projects designed to achieve specific research objectives outlined in the National ITS Program Plan under section 5205 of the Transportation Equity Act for the 21st Century or the Surface Transportation Research and Development Strategic Plan developed under section 5208 of Title 23, United States Code; or

2. The upgrade or expansion of an ITS system in existence on the date of enactment of the Transportation Equity Act for the 21st Century if the Secretary determines that the upgrade or expansion—

a. Would not adversely affect the goals or purposes of Subtitle C (Intelligent Transportation Systems) of the Transportation Equity Act for the 21st Century and

b. Is carried out before the end of the useful life of such system; and

c. Is cost-effective as compared to alternatives that would meet the conformity requirement of this rule

(c) These provisions do not apply to funds used for Operations and Maintenance of an ITS system in existence on June 9, 1998.

V. Regional ITS Architecture

(a) A regional ITS architecture shall be developed to guide the development of ITS projects and programs and be consistent with ITS strategies and projects contained in applicable transportation plans. The National ITS Architecture shall be used as a resource in the development of the regional ITS architecture. The regional ITS architecture shall be on a scale

commensurate with the scope of ITS investment in the region. Provision should be made to include participation from the following agencies, as appropriate, in the development of the regional ITS architecture: Highway agencies; public safety agencies (*e.g.*, police, fire, emergency/medical); transit agencies; federal lands agencies; state motor carrier agencies; and other operating agencies necessary to fully address regional ITS integration.

(b) Any region that is currently implementing ITS projects shall have a regional ITS architecture February 7, 2005.

(c) All other regions not currently implementing ITS projects shall have a regional ITS architecture within four years of the first ITS project for that region advancing to final design.

(d) The regional ITS architecture shall include, at a minimum, the following:

(1) A description of the region;
(2) Identification of participating agencies and other stakeholders;
(3) An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture;

(4) Any agreements (existing or new) required for operations, including at a minimum those affecting integration of ITS projects; interoperability of different ITS technologies, utilization of ITS-related standards, and the operation of the projects identified in the regional ITS architecture;

(5) System functional requirements;

(6) Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture);

(7) Identification of ITS standards supporting regional and national interoperability;

(8) The sequence of projects required for implementation of the regional ITS architecture.

(e) Existing regional ITS architectures that meet all of the requirements of section V(d) shall be considered to satisfy the requirements of V(a).

(f) The agencies and other stakeholders participating in the development of the regional ITS architecture shall develop and implement procedures and responsibilities for maintaining the regional ITS architecture, as needs evolve within the region.

VI. Project Implementation

(a) All ITS projects funded with mass transit funds from the highway trust

fund shall be based on a systems engineering analysis.

(b) The analysis should be on a scale commensurate with the project scope.

(c) The systems engineering analysis shall include, at a minimum:

(1) Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS Architecture).

(2) Identification of participating agencies' roles and responsibilities;

(3) Requirements definitions;

(4) Analysis of alternative system configurations and technology options to meet requirements;

(5) Analysis of financing and procurement options;

(6) Identification of applicable ITS standards and testing procedures; and

(7) Procedures and resources necessary for operations and management of the system;

(d) Upon completion of the regional ITS architecture required in section V, the final design of all ITS projects funded with highway trust funds shall accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. If the final design of the ITS project is inconsistent with the regional ITS architecture, then the regional ITS architecture shall be updated as per the process defined in V(f) to reflect the changes.

(e) Prior to completion of the regional ITS architecture, any major ITS project funded with highway trust funds that advances to final design shall have a project level ITS architecture that is coordinated with the development of the regional ITS architecture. The final design of the major ITS project shall accommodate the interface requirements and information exchanges as specified in this project level ITS architecture. If the project final design is inconsistent with the project level architecture, then the project level ITS architecture shall be updated to reflect the changes. The project level ITS architecture is based on results of the systems engineering analysis, and includes the following:

(1) A description of the scope of the ITS project

(2) An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the ITS project;

(3) Functional requirements of the ITS project;

(4) Interface requirements and information exchanges between the ITS project and other planned and existing systems and subsystems; and

(5) Identification of applicable ITS standards

(b) All ITS projects funded with Mass Transit Funds from the Highway Trust Funds shall use applicable ITS standards and interoperability tests that have been officially adopted through

rulemaking by the United States Department of Transportation (US DOT).

(c) Any ITS project that has advanced to final design by (effective date of policy) is exempt from the requirements of VI.

VII. Project Oversight

(a) Prior to authorization of Mass Transit Funds from the Highway Trust Fund for acquisition or implementation of ITS projects, grantees shall self-certify compliance with sections V and VI. Compliance with this policy shall be monitored under normal FTA oversight procedures, to include annual risk assessments, triennial reviews, and program management oversight reviews as applicable.

(b) Compliance with the following FTA Circulars shall also be certified:

- C5010.1C, Grant Management Guidelines
- C6100.1B, Application Instructions and Program Management Guidelines

VIII. FTA Guidance

FTA will develop appropriate guidance materials regarding the National ITS Architecture Consistency Policy.

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Nuria I. Fernandez,
Acting Administrator.

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APPENDIX B

PRIORITIZATION OF ITS USER SERVICES AND MARKET PACKAGES

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PRIORITIZATION OF ITS USER SERVICES AND MARKET PACKAGES

1.1 Introduction

Many of the previous ITS Strategic Plans undertaken throughout the United States have utilized the planning process documented in the IVHS Planning and project deployment process dated April 1, 1993, which requires development of a User Services Plan. The most recent ITS planning process defined in the *Interim Handbook on ITS Planning* (FHWA, 1996), replaces the User Services Plan concept with the Market Package Plan. This modified process is consistent with the National ITS Architecture. Due to the above information, as well as the fact that development of a User Services Plan was defined in the original scope of services for this contract and there is a direct relationship between the user service requirements and the National ITS Architecture, a decision was made to screen and prioritize both user services and market packages for applicability to the transportation goals and objectives of the Shreveport/Bossier City region.

User services are specific services and benefits that can be offered to users. The user service approach is intended to place the emphasis of discussions about ITS on the development and deployment of useful ITS products and services for a range of defined users to meet specified needs. Thirty-two (32) user services have been defined and developed through the Federal program planning process. These user services form the basis of the user service requirements employed in the development of the National ITS Architecture.

Market packages provide an accessible deployment oriented perspective to the National ITS Architecture. They are packages tailored to fit, separately or in combination, real-world transportation problems and needs. Market packages address the specific service requirements of traffic managers, transit operators, travelers, and other ITS shareholders.

Once defined, together user services and market packages form a bridge or link between the stated goals, objectives, and transportation deficiencies of a region to development of the regional ITS architecture and implementation strategies.

The purpose of this task is to screen, identify and prioritize user services and market packages, which effectively address the previously defined goals, objectives and transportation deficiencies.

The following is a summary of user services and market package issues:

- User services and market packages are concepts used in the **National ITS Architecture**

- **System architecture** = depiction of an ITS system (project-specific or regional), that identifies components and relationships, organized around functions.
- **National ITS Architecture** = developed by USDOT, uses **a specific set of concepts and terms** (“Lego”, not “Tinkertoy” or “Lincoln Logs”); covers the full, multi-modal range of *likely* ITS implementations. Intended to:
 - Promote interoperability and coordination of ITS across jurisdictions
 - Facilitate ITS design and implementation – saves time, minimizes omissions and lost opportunities, facilitates expansion
 - Foster a national vendor market oriented around standards
- **User services** = describe ITS services that can be provided to address user needs, what ITS can provide from the perspective of user needs, e.g. “Pre-Trip Traveler Information”, “Traffic Control”, “En-Route Transit Information”.
- **User services are the “gateway” to the National ITS Architecture**, first step in developing a system architecture; link local ITS related needs and projects to the architecture.
- **Market packages** = describe collections of equipment packages that provide the functions necessary to deliver user services. E.g., “Network Surveillance”, “Broadcast Traveler Information”.
- **32 user services** in the National ITS Architecture.
- **63 market packages** in the National ITS Architecture
- **Identify local user services** based on local transportation issues or deficiencies (i.e., “user needs”).
- **Identify local market packages** based on identified local user services (relationship documented in National ITS Architecture)

1.2 User Services

The user services are defined, not along lines of common technologies, but to meet the safety, mobility, comfort and other transportation-related needs of transportation users and providers. The user services are closely related to achieving the goals and objectives for ITS and are an integral part of the national ITS architecture.

There are thirty-two (32) user services and they have been grouped into “bundles”. **Table B-1** presents the most recent bundling included in the National ITS Architecture Standards. The

services within these bundles may be related in a number of different ways. In some cases, the institutional perspectives of organizations that will deploy the services provided the relational for the formation of a specific bundle. In other cases, bundles were organized around common technical functionalities.

Table B.1 National ITS Architecture User Services

User Services Bundle	User Services
Travel and Transportation Management	<ul style="list-style-type: none">• En-Route Driver Information• Route Guidance• Traveler Services Information• Traffic Control• Incident Management• Emissions Testing and Mitigation• Demand Management and Operations• Pre-trip Travel Information• Ride Matching and Reservation• Highway-Rail Intersection• Maintenance and Construction Operations
Public Transportation Operations	<ul style="list-style-type: none">• Public Transportation Management• En-Route Transit Information• Personalized Public Transit• Public Travel Security
Electronic Payment	<ul style="list-style-type: none">• Electronic Payment Services
Commercial Vehicle Operations	<ul style="list-style-type: none">• Commercial Vehicle Electronic Clearance• Automated Roadside Safety Inspection• On-board Safety Monitoring• Commercial Vehicle Administration Processes• Hazardous Materials Incident Response• Freight Mobility
Emergency Management	<ul style="list-style-type: none">• Emergency Notification and Personal Security• Emergency Vehicle Management
Advanced Vehicle Safety Systems	<ul style="list-style-type: none">• Longitudinal Collision Avoidance• Lateral Collision Avoidance• Intersection Collision Avoidance• Vision Enhancement for Crash Avoidance• Safety Readiness• Pre-Crash Restraint Deployment• Automated Highway System
Information Management	<ul style="list-style-type: none">• Archived Data Function

The following is a brief description of each of the User Services.

1.2.1 Travel and Transportation Management Bundle

The user services in the travel and transportation management bundle are designed to use advanced systems and technologies to improve safety and create more informed travelers. A secondary purpose (sometimes identified separately as Travel Demand Management) is to reduce the vehicle demands on the existing roadway infrastructure by encouraging the use of multiple or high occupancy vehicles (HOV), public transportation systems, ride-sharing programs and

altering normal travel patterns to reduce the demand on the existing systems.

En-Route Driver Information

This User Service provides travel-related information to drivers after their trips have begun. This information could include real-time traffic (roadway travel speeds, accident/ incident location), real-time transit (schedule, status) and roadway conditions (temperature, icy/snow covered roadways). By providing this information to travelers while en-route, it allows alternative routes to be chosen for their destination. Driver Information consists of two major functions, which are (1) Driver Advisory and (2) In-vehicle signing. The potential decrease in traffic may also provide benefits in highway safety, reduced air pollution, and decreased congestion.

Route Guidance

This User Service provides travelers with instructions on turns and other maneuvers to reach their destinations. This information could be presented in real time to a driver as he/she progresses along a route or in a static form to an individual using a personal computer or traveler information kiosk. Four functions are provided which are (1) Provide Directions, (2) Static Mode, (3) Real-time Mode, and (4) User Interface.

Traveler Services Information

Most often referred to as “electronic yellow pages”, traveler services data includes local information (location, operational hours, phone numbers) such as hotel/motels, gas stations, restaurants, and other points of interest and is provided to assist the traveler prior to embarking on a trip or after the traveler is underway. The functions which are included in this capability are Information Receipt and Information Access.

Traffic Control

This User Service provides information to manage the movement of traffic on streets and highways, which includes surface street controls such as adaptive signal systems and freeway controls such as ramp metering and lane control. Four functions are provided which are (1) traffic Flow Optimization, (2) Traffic Surveillance, (3) Control Function, and (4) Provide Information. This service will also include control of network signal systems with eventual integration of freeway control.

Incident Management

This User Service provides the necessary information to enhance existing capabilities for detecting incidents and taking the appropriate actions in response to them. Six major functions are provided which are (1) Scheduled Planned Incidents, (2) Identify Incidents, (3) Formulate Response Actions, (4) Support Coordinated Implementation of Response Actions, (5) Support Initialization of Response to Actions, and (6) Predict Hazardous Conditions.

Emissions Testing and Mitigation

This User Service provides information on an area-wide and roadside basis to assist in improving air quality levels. This information can be used by state and local governments to enhance their air quality control strategies. Information gleaned from this service will be used by Traffic Demand Management in the Traffic Management Center to mitigate pollution and may be provided to enforcement agencies to compel offenders to comply with standards.

Demand Management and Operations

This User Service provides information to allow implementation of programs, policies, and regulations designed to increase occupancy of vehicles (HOV lanes, commute options programs) and provide multi-modal options to allow individuals to travel more efficiently, at a different time or to a different location. It consists of two major functions, which are (1) Increase Efficiency of Transportation system and (2) Provide Wide Variety of Mobility Options.

Pre-Trip Travel Information

This User Service provides travelers with information prior to their departure and before a mode selection must be made. By providing travelers with travel information before they leave their origin, this user service assists travelers in making mode choices, travel time estimates, and route decisions prior to trip departure. This service consists of four major functions, which are: (1) Available Services Information, (2) Current situation Information, (3) trip Planning Service, and (4) User Access. Information is integrated from various transportation modes and presented to the user for decision making.

Ride Matching and Reservation

This User Service provides a key TDM strategy for reducing roadway and vehicle demand by developing and encouraging ride sharing as an alternative form of travel. This Ride Matching and Reservation will provide travel users with information on rideshare providers. Three major functions are provided which are (1) Rider Request, (2) Transportation Provider Services, and (3) Information Processing. This service will also include a billing service to the providers.

Highway-Rail Intersection

This User Service provides information to improve control of train and highway traffic to avoid and reduce the severity of collisions on at-grade highway-rail intersections (HRI). Two sub-services are supported: Standard Speed Rail Subservice which is applicable to light rail transit, commuter rail and heavy rail trains with operational speeds up to 79 miles per hour; and High Speed Rail Subservice which is applicable to all passenger and freight trains with operational speeds from 80 to 125 miles per hour.

Maintenance and Construction Operations

This User Service focuses on activities pertaining to the monitoring, operating, maintaining, improving and managing the physical condition of the roadway, associated infrastructure equipment on the roadway, and the available resources necessary to conduct these activities. This User Service focuses on four functional areas: Maintenance Vehicle Fleet Management (including tracking, routing, scheduling, dispatching); Roadway Management (including pavement condition monitoring and hazardous road conditions remediation); Work Zone Management and Safety (systems that insure safe roadway operations during construction and other work zone activities and communicate with the traveler); and Roadway Maintenance Conditions and Work Plan Dissemination (dissemination/coordination of work plans to affected staff and organizations).

1.2.2 Public Transportation Operations Bundle

The services included in public transportation operations are designed to decrease reliance on the personal auto by enhancing the efficiency, convenience, cost effectiveness, safety, and security of public transportation.

Public Transportation Management

This User Service provides information on the application of advanced vehicle electronic systems to various public transportation modes. In addition, this service uses the data generated by these electronic systems to improve the quality of service to the traveling public. Activities in this area are typically grouped into three categories: 1) Operation of vehicles and facilities, 2) Planning and scheduling, and 3) Personnel management.

En-Route Transit Information

This User Service provides information to transit riders while they are on a public transportation system. The information typically includes real-time, accurate transit and high-occupancy vehicle information (such as the next scheduled arrival or departure for transit service) so travelers can select the most appropriate and convenient form of transportation. This information helps travelers plan and modify their trips while underway. It consists of three major functions, which are (1) Information Distribution, (2) Information Receipt, and (3) Information Processing. This service integrates information from different transit modes and presents it to travelers for decision making.

Personalized Public Transit

This User Service involves use of flexible routed transit vehicles offering more convenient/personalized service to transit customers. Personalized services include random-route (Dial-A-Ride) transit, fixed-route transit capable of deviating on call and resuming the fixed route, and specialized transportation for the transit dependent. This service consists of five major functions, which are (1) Rider Request, (2) Vehicle Assignment, (3) Data Collection, (4) Information Processing, and (5) Communications.

Public Travel Security

This User Service provides data on the public transit environment to help make transit patrons feel more secure, comfortable, and safer without detracting from transit ridership. Typically, this service involves deploying technologies both at fixed locations (such as parking lots and transit stops/stations) and to mobile systems (in-vehicle) designed to provide safety and security for the transit riders and employees. It involves four major functions which are, (1) Secure Areas, (2) Security Sensors, (3) Personal Sensors Items, and (4) Security Management and Control.

1.2.3 Electronic Payment Bundle

This user service bundle involves the ability to provide travelers with a common electronic payment medium for travel-related services.

Electronic Payment Services

This User Service provides travelers with the ability to make non-cash payments for transportation services using electronic cards or tags. Four functions are provided which are (1) Electronic Toll Collection, (2) Electronic Fare Collection, (3) electronic parking payment, and (4) Electronic Payment Services Integration.

1.2.4 Commercial Vehicle Operations Bundle

This bundle of user services deals primarily with freight movement and focuses on two specific areas: those, which improve private-sector fleet management and freight mobility, and those, which streamline government/regulatory functions.

Commercial Vehicle Electronic Clearance

This User Service provides information on both domestic and international electronic clearance. Today's requirement for commercial trucks and buses to stop at checkpoints for inspection/weighing significantly impacts commercial vehicle operational utilization and productivity. This service focuses on technologies and services that can allow the vast majority of commercial vehicles (those operating within the local, State, and Federal regulatory requirements) to travel the nation's interstate system just as passenger vehicles do. The electronic clearance would allow only selected vehicles (those with identified problems, or areas that need to be checked) to be stopped at checkpoints while the remainder of the vehicles pass undisturbed.

Automated Roadside Safety Inspection

This User Service provides the ability to automate inspection capabilities that check commercial vehicle safety requirements. Technologies in this user service area will allow for quicker inspection of commercial vehicles either at stationary roadside checkpoints or at mobile stations. This service provides three primary functions, which are (1) Automated Roadside Safety Inspection, (2) Roadside Facility, and (3) Vehicle System.

On-Board Safety Monitoring

This User Service focuses on technologies that allow on-board monitoring of safety warnings to the driver; integration of real-time safety information about the vehicle, driver, or cargo with the electronic clearance user service; and pre- and post-trip inspections. The goal of the monitoring system are to first inform the driver, as soon as possible, of any problem that has been detected. Of secondary importance is notifying the carrier of detected safety problems. Last in importance is the notification of appropriate enforcement agencies.

Commercial Vehicle Administrative Processes

This service focuses on technologies in three areas: electronic purchase of credentials, automated mileage and fuel reporting and auditing, and International Border Electronic Clearance. Technologies in this area will allow a carrier to electronically apply for and purchase credentials for their home state, other states, and even internationally. In addition, automated mileage and fuel reporting would be available electronically, reducing the administrative and record keeping requirements on the carrier, the driver and the States. The international electronic clearance component will extend the electronic clearance concept to the Mexican and Canadian borders and support the North American Free Trade Agreement (NAFTA) by facilitating traffic flow of safe and legal carriers across international borders.

Hazardous Materials Incident Response

This User Service focuses on providing information to emergency responders at the scene of an accident. It includes three primary functions, which are (1) HAZMAT Incident Notification, (2) Operational Focal Point, and (3) Communications.

Freight Mobility

This User Service provides real-time communications between drivers of commercial vehicles and their dispatchers to facilitate vehicle location, intermodal transportation providers, and real-time routing using congestion or incident information.

1.2.5 Emergency Management Bundle

This bundle of services relates directly to the detection, notification and response to emergency and non-emergency incidents that take place on or adjacent to the roadway. Emergency management services focus mostly on improving the ability of police, fire and rescue operations to provide an appropriate response to emergency situations.

Emergency Notification and Personal Security

Often referred to as “mayday” capabilities, this User Service focuses on either a driver-initiated distress signal for incidents such as mechanical breakdown or non-injury incidents or automated notification of collisions by automatically sending information regarding location, nature, and severity of the crash to an emergency medical service dispatcher. This service consists of two

primary functions, which are Emergency Notification and Personal Security and Automated Collision Notification.

Emergency Vehicle Management

This User Service provides information designed to reduce the time between notification of an emergency situation and the arrival at the scene of emergency vehicles. This consists of activities in three areas: 1) Emergency Vehicle Fleet Management; 2) Route Guidance; and 3) Signal Priority.

1.2.6 Advanced Vehicle Safety Systems Bundle

This bundle of user services relate directly to improving driver safety by reducing the number and severity of accidents and incidents.

Longitudinal Collision Avoidance

This User Service provides information to reduce the number and severity of head-on, rear-end and backing accidents. This type of collision avoidance focuses on four areas: 1) Rear-end collision warning and control through driver notification, vehicle control, and avoidance of either the rear-end or stationary object; 2) Head-On Collision Warning and Control that detects an impending head-on collision; and 3) Backing Collision Warning that detects slow-moving or stationary objects (livestock, humans, vehicles) in the path and warns the driver.

Lateral Collision Avoidance

This User Service provides information to augment the driver's ability to notice and avoid collisions caused when a vehicle leaves its own lane of travel while moving forward. This vehicle control and safety system focuses mostly on two technology areas: 1) Lane Change/Blind Spot Situation Display, Collision Warning, and Control; and 2) Lane/Road Departure Warning and Control.

Intersection Collision Avoidance

This User Service provides vehicle operators with assistance in avoiding collisions at intersections when vehicles improperly violate the right-of-way of another vehicle, or when the right-of-way is not clear.

Vision Enhancement for Crash Avoidance

This User Service provides information systems that can improve the ability of the driver to perceive the roadway itself and objects on and along the roadway, enabling the driver to avoid potential accidents.

Safety Readiness

This User Service focuses on reducing the number of incidents caused by impaired drivers, vehicle component failures or degraded infrastructure conditions. Driver impairment warning systems provide indications that the driver may not be in a condition to continue operating the vehicle safely. Vehicle condition warning extends existing safety monitoring systems to include components such as tire pressure or brake temperature. In-vehicle infrastructure condition warning focuses on providing information to the vehicle from instruments or systems mounted in the roadway infrastructure that warn of deteriorating road conditions due to water, ice, or snow.

Pre-Crash Restraint Deployment

This User Service provides information and technology to both anticipate imminent collisions and to deploy passenger safety systems prior to impact.

Automated Vehicle Operation

This User Service focuses on improving the safety and efficiency of highway travel, enhancing driver comfort and helping to reduce air pollution by moving suitably equipped vehicles under fully automated control along dedicated highway lanes. Drivers enter an automated highway system lane through a check-in area where the system: 1) checks the worthiness of the vehicle and driver; 2) accepts or rejects vehicles for operation on the system; and 3) diverts disapproved vehicles back to the non-automated lanes.

1.2.7 Information Management Bundle

This bundle contains one user service that focuses on data archival.

Archived Data Function

This User Service controls the archiving and distribution of ITS data. The Archived Data User Service provides the Historical Data Archive Repositories and controls the archiving functionality for all ITS data with five major functions: 1) the Operational Data Control function to manage operations data integrity; 2) the Data Import and Verification function to acquire historical data from the Operational Data Control function; 3) the Automatic Data Historical Archive function for permanently archiving the data; 4) the Data Warehouse Distribution function, which integrates the planning, safety, operations, and research communities into ITS and processes data products for these communities; and 5) the ITS Community Interface which provides the ITS common interface to all ITS users for data products specification and retrieval. The Archived Data Function User Service helps achieve the ITS information goal of unambiguous interchange and reuse of data and information throughout all functional areas.

1.3 Market Packages

Market packages define deployment oriented transportation services that are tailored to fit, separately or in combination, real-world transportation problems and needs. They are specifically designed for traffic managers, transit operators, travelers and other ITS stakeholders.

Market packages are structured to segregate services that are likely to encounter technical or non-technical challenges from lower risk services. This approach identifies a subset of the market packages that possess early deployment capabilities. At the other end of the spectrum, several of the market packages represent advanced products or services that will not be available for some time. Many of the market packages are also incremental so that more advanced packages can be efficiently implemented by building on common elements that were deployed earlier with more basic packages.

A listing of all market packages are documented in *Table B.2* and a brief description of each market package follows.

Table B.2 National ITS Architecture Market Packages

Market Package Category	Market Package
Advanced Traffic Management Systems	<ul style="list-style-type: none"> • Network Surveillance • Probe Surveillance • Surface Street Control • Freeway Control • HOV Lane Management • Traffic Information Dissemination • Regional Traffic Control • Incident Management System • Traffic Forecast And Demand Management • Electronic Toll Collection • Emissions Monitoring And Management • Virtual TMC And Smart Probe Data • Standard Railroad Grade Crossing • Advanced Railroad Grade Crossing • Railroad Operations Coordination • Parking Facility Management • Reversible Lane Management • Road Weather Information System • Regional Parking Management
Advanced Public Transportation Systems	<ul style="list-style-type: none"> • Transit Vehicle Tracking • Transit Fixed-Route Operations • Demand Response Transit Operations • Transit Passenger And Fare Management • Transit Security • Transit Maintenance • Multi-Modal Coordination • Transit Traveler Information

Table B.2 National ITS Architecture Market Packages

Market Package Category	Market Package
Advanced Traveler Information Systems	<ul style="list-style-type: none"> • Broadcast Traveler Information • Interactive Traveler Information • Autonomous Route Guidance • Dynamic Route Guidance • ISP Based Route Guidance • Integrated Transportation Management / Route Guidance • Yellow Pages And Reservation • Dynamic Ridersharing • In-Vehicle Signing
Advanced Vehicle Safety Systems	<ul style="list-style-type: none"> • Vehicle Safety Monitoring • Driver Safety Monitoring • Longitudinal Safety Warning • Lateral Safety Warning • Intersection Safety Warning • Pre-Crash Restraint Deployment • Driver Visibility Improvement • Advanced Vehicle Longitudinal Control • Advanced Vehicle Lateral Control • Intersection Collision Avoidance • Automated Highway System
Emergency Management	<ul style="list-style-type: none"> • Emergency Response • Emergency Routing • Mayday Support
Archived Data	<ul style="list-style-type: none"> • ITS Data Mart • ITS Data Warehouse • ITS Virtual Data Warehouse
Commercial Vehicle Operations	<ul style="list-style-type: none"> • Fleet Administration • Freight Administration • Electronic Clearance • CV Administrative Processes • International Border Electronic Clearance • Weigh-In Motion • Roadside CVO Safety • On-Board CVO Safety • HAZMAT Management • CVO Fleet Maintenance

1.3.1 Advanced Traffic Management System Market Packages

Network Surveillance

This basic market package provides fixed roadside surveillance elements utilizing wireline communication to transmit the surveillance data. It can be used completely local such as loop detection connected with signal control or it can be CCTVs sending back data to the agency's management center. This enables the monitoring of expressway conditions, identify and verify

incidents, analyze and reduce the collected data, and make it available to users and potential private information providers. Network surveillance requires road sensors, communication links between the sensors and traffic management systems, data reduction software and typically utilizes wireline links between the Traffic Management Center and the traveler information providers.

Probe Surveillance

This market package provides an alternative approach for surveillance of the roadway network. Dedicated short-range communications between the vehicle and roadside are used to provide current vehicle location and station to the traffic management subsystem. This approach utilizes existing vehicle equipment to support in-vehicle signing, automatic vehicle location (AVL), and other short-range communications applications identified within the architecture. The market package enables monitoring of road conditions, identify incidents, analyze and reduce the collected data, and make it available to users and private information providers. It requires the dedicated short range communications identified above, roadside beacons and wireline communications for short range communications, data reduction software, and utilizes wireline links between the traffic management subsystem and information service provider to share the collected information. Both “Opt out” and “Opt in” strategies are available to ensure the user has the ability to turn off the probe functions to ensure individual privacy. Due to the large volume of data collected by probes, data reduction techniques are required in this market package which include the ability to identify and filter out-of-bounds or extreme data reports.

Surface Street Control

This market package provides the central control and monitoring equipment, communication links, and the signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented by this market package ranging from static pre-timed control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Additionally, general advisory and traffic control information can be provided to the driver while en-route. This market package is generally an intra-jurisdictional package that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal coordination.

Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.

Freeway Control

This market package provides the communications and roadside equipment to support ramp control, lane controls, and interchange control for freeways. Coordination and integration of ramp meters are included as part of this market package. This package is consistent with typical urban traffic freeway control systems. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option. This market package also includes the capability to utilize surveillance information

for detection of incidents. Typically, the processing would be performed at a traffic management center; however, developments might allow for point detection with roadway equipment. For example, a CCTV might include the capability to detect an incident based upon image changes. Additionally, this market package allows general advisory and traffic control information to be provided to the driver while en-route.

HOV Lane Management

This market package manages HOV lanes by coordinating freeway ramp meters and connector signals with HOV lane usage signals. Preferential treatment is given to HOV lanes using special bypasses, reserved lanes, and exclusive rights-of-way that may vary by time of day. Vehicle occupancy detectors may be installed to verify HOV compliance and to notify enforcement agencies of violations.

Traffic Information Dissemination

This market package allows traffic information to be disseminated to drivers and vehicles using roadway equipment such as dynamic message signs or highway advisory radio. This package provides a tool that can be used to notify drivers of incidents; careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), transit management center, emergency management center, and information service provider.

Regional Traffic Control

This market package provides the ability to share traffic information and control among traffic management centers to support a regional control strategy. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Arterial Street Traffic Coordination and freeway control market packages (ramp metering and interchange control, lane control, and reversible lane management) and adds hardware, software, and wireline communications capabilities to implement traffic management strategies which are coordinated between neighboring Traffic Management Subsystems. Several levels of coordination are supported from sharing of information through sharing of control between traffic management subsystems.

Incident Management System

This market package manages both predicted and unexpected incidents so that the impact to the transportation network and traveler safety is minimized. Requisite incident detection capabilities are included in the freeway control market package and through the regional coordination with other traffic management and emergency management centers, weather service entities, and event promoters supported by this market package. Information from these diverse sources are collected and correlated by this market package to detect and verify incidents and implement an

appropriate response. This market package provides Traffic Management Subsystem equipment that supports traffic operations personnel in developing an appropriate response in coordination with emergency management and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications and presentation of information to affected travelers using the Traffic Information Dissemination market package. The same equipment assists the operator by monitoring incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other field service personnel.

Traffic Forecast and Demand Management

This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the Traffic Management Subsystem itself as well as other traffic management centers and predicted traffic loads derived from route plans supplied by the Information Service Provider Subsystem. In addition to short-term forecasts, this market package provides longer-range forecasts that can be used in transportation planning. This market package provides data that supports the implementation of TDM programs, and policies managing both traffic and the environment. Information on vehicle pollution levels, parking availability, usage levels, and vehicle occupancy are collected by monitoring sensors to functions. Demand management requests can also be made to Toll Administration, Transit Management, and Parking Management Subsystems.

Electronic Toll Collection

This market package provides toll operators with the ability to collect tolls electronically and detect and process violators. Variations in the fees that are collected enables implementation of demand management strategies. Dedicated short-range communication between the roadway equipment and the vehicle is required as well as wireline interfaces between the toll collection equipment and transportation authorities and the financial infrastructure that supports fee collection. Vehicle tags of toll violators are read and electronically posted to vehicle owners. Standards, inter-agency coordination, and financial clearinghouse capabilities enable regional, and ultimately national interoperability for these services. The population of toll tags and roadside readers that these systems utilize can also be used to collect road use statistics for highway authorities. This data can be collected as a natural by-product of the toll collection process or collected by separate readers that are dedicated to probe data collection.

Emissions Monitoring and Management

This market package monitors individual vehicle emissions and provides general air quality monitoring using distributed sensors to collect the data. The collected information is transmitted to the emissions management subsystem for processing. Both individual detection and identification of vehicles that exceed emissions standards and general area-wide monitoring of air quality are supported by this market package. For area wide monitoring, this market package measures air quality, identifies sectors that are non-compliant with air quality standards, and

collects, stores and reports supporting statistical data. For point emissions monitoring, this market package measures tail pipe emissions and identifies vehicles that exceed emissions standards. The gathered information can be used to implement environmentally sensitive TDM programs, policies, and regulations.

Virtual TMC and Smart Probe Data

This market package provides for the special requirements of a rural road system. Instead of a central TMC, the traffic management is distributed over a very wide area (e.g., a whole state or collection of states). Each locality has the capability of accessing available information for assessment of road conditions. The package uses vehicles as smart probes that are capable of measuring road conditions and providing this information to the roadway for relay to the Traffic Management Subsystem and potentially direct relay to following vehicles (i.e., the automated road signing equipment is capable of autonomous operation) In-vehicle signing is used to inform drivers of detected road conditions.

Standard Railroad Grade Crossing

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem.

Advanced Railroad Grade Crossing

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements demand advanced features (e.g., where rail operational speeds are greater than 80 miles per hour). This market package includes all capabilities from the Standard Railroad Grade Crossing Market Package and augments these with additional safety features to mitigate the risks associated with higher rail speeds. The active warning systems supported by this market package include positive barrier systems, which preclude entrance into the intersection when the barriers are activated. Like the Standard Speed package, the HRI equipment is activated on notification by wayside interface equipment, which detects, or communicates with the approaching train. In this market package, additional information about the arriving train is also provided by the wayside interface equipment so that the train's direction of travel, its estimated time of arrival, and the estimated duration of closure may be derived. This enhanced information may be conveyed to the driver prior to, or in context with, warning system activation. This market package also includes additional detection capabilities, which

enable it to detect an entrapped or otherwise immobilized vehicle within the HRI and provide an immediate notification to highway and railroad officials.

Railroad Operations Coordination

This market package provides an additional level of strategic coordination between rail operations and traffic management centers. Rail operations provides train schedules, maintenance schedules, and any other forecast events which will result in highway-rail intersection (HRI) closures. This information is used to develop forecast HRI closure times and durations, which may be used in advanced traffic control strategies, or to enhance the quality of traveler information.

Parking Facility Management

This market package provides enhanced monitoring and management of a parking facility. The included equipment assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This is performed by sensing and collecting current parking facility status, sharing the data with information service providers and traffic operations, and automatic fee collection using short range communications with the same in-vehicle equipment utilized for electronic toll collection.

Reversible Lane Management

This market package provides for the management of reversible lane facilities. In addition to standard surveillance capabilities, this market package includes sensory functions that detect wrong-way vehicles and other special surveillance capabilities that mitigate safety hazards associated with reversible lanes. The package includes the field equipment, physical lane access controls, and associated control electronics that manage and control these special lanes. This market package also includes the equipment used to electronically reconfigure intersections and manage right-of-way to address dynamic demand changes and special events.

Road Weather Information System

This market package monitors current and forecast road and weather conditions using a combination of weather service information and data collected from environmental sensors deployed on and about the roadway. The collected road weather information is monitored and analyzed to detect and forecast environmental hazards such as icy road conditions, dense fog, and approaching severe weather fronts. This information can be used to more effectively deploy road maintenance resources, issue general traveler advisories, and support location specific warnings to drivers using the Traffic Information Dissemination Market Package.

Regional Parking Management

This market package supports coordination between parking facilities to enable regional parking management strategies.

1.3.2 Advanced Public Transportation Systems Market Packages

Transit Vehicle Tracking

This market package provides for an Automated Vehicle Location system to track the transit vehicle's real time schedule adherence and updates the transit system's schedule in real-time. Vehicle position may be determined either by the vehicle (e.g., through GPS) and relayed to the infrastructure or may be determined directly by the communications infrastructure. A two-way wireless communication link with the transit management center is used for relaying vehicle position and control measures. Fixed route transit systems may also employ beacons along the route to enable position determination and facilitate communications with each vehicle at fixed intervals. In this implementation, communications between the transit vehicle and transit management center includes both dedicated short range and wireline communications components. The transit management center processes this information, updates the transit schedule and makes real-time schedule information available to the information service provider via a wireline link.

Transit Fixed-Route Operations

This market package performs automatic driver assignment and monitoring, as well as, vehicle routing and scheduling for fixed-route services. This service uses the existing AVL database as a source for current schedule performance data, and is implemented through data processing and information display at the transit management subsystem. This data is exchanged using the existing wireline link to the information service provider where it is integrated with that from other transportation modes (e.g. rail, ferry, air) to provide the public with integrated and personalized dynamic schedules.

Demand Response Transit Operations

This market package performs automatic driver assignment and monitoring as well as vehicle routing and scheduling for demand response transit services. This package uses the existing AVL database to monitor current status of the transit fleet and supports allocation of these fleet resources to service incoming requests for transit service. The Transit Management Subsystem provides the necessary data processing and information display to assist the transit operator in making optimal use of the transit fleet. Traveler equipment is also included within this market package to enable traveler requests for flexible route transit and paratransit service. The Information Service Provider that provides the interface to the traveler devices may be either part and parcel of the transit management center or be independently owned and operated by a separate service provider. In the first scenario, the traveler makes a direct request to a specific paratransit service. In the second scenario, a third party service provider determines the paratransit service is a viable means of satisfying a traveler request and uses wireline communications to make a reservation for the traveler.

Transit Passenger and Fare Management

This market package allows for the management of passenger loading and fare payments on-board vehicles using electronic means. This package is implemented with sensors mounted on the vehicle to permit the driver and central operations to determine vehicle loads, and readers located either in the infrastructure or on-board the transit vehicle to allow fare payment. Data is processed, stored, and displayed on the transit vehicle and communicated as needed in the Transit Management Center using wireless existing infrastructure or is periodically dumped to a database at the transit center.

Transit Security

This market package provides for the physical security of transit passengers. An on-board security system is deployed to perform surveillance and warn of potentially hazardous situations. Transit areas (e.g. stops, park and ride lots, stations) are also monitored. Information is communicated to the Transit Management Center using the existing or emerging wireless (vehicle to center) or wireline (area to center) infrastructure. Security related information is also transmitted to the Emergency Management Center when an emergency is identified that requires an external response.

Transit Maintenance

This market package supports automatic maintenance scheduling and monitoring. On-board condition sensors monitor critical system status and transmit critical status information to the transit management center. Hardware and software in the transit management center processes this data and schedules maintenance activities.

Multi-modal Coordination

This market package establishes two way communications between multiple transit and traffic agencies to improve service coordination. Intermodal coordination between transit agencies can increase traveler convenience at transfer points and also improve operating efficiency. Coordination between traffic and transit management is intended to improve on-time performance of the transit system to the extent that this can be accommodated without degrading overall performance of the traffic network. More limited local coordination between the transit vehicle and the individual intersection for signal priority is also supported by this package.

Transit Traveler Information

This market package provides transit users at transit stops and on-board transit vehicles with ready access to transit information. The information services include transit stop annunciation, imminent arrival signs, and real-time transit schedule displays that are of general interest to transit users. Systems that provide custom transit trip itineraries and other tailored transit information services are also represented by this market package.

1.3.3 Advanced Traveler Information Systems Market Packages

Broadcast Traveler Information

This market package enhances the roadside traveler information by providing the expressway customers with a basic set of ATIS services. It involves the collection of traffic conditions, advisories, general public transportation and parking information and the “near real time” dissemination of this information over a wide area through existing infrastructures and low cost user equipment (e.g., FM subcarrier, cellular data broadcast). This package could also ensure that information is available in a format for media usage, such as a fax output or a direct tie-in to radio and television station computer systems. Different from the market package roadside traveler information, this market package provides the more sophisticated digital broadcast service to users through the broadcast media to their homes or to their vehicles. Successful deployment of this market package relies on availability of real-time transportation data from expressway instrumentation, probe vehicles or other sources and would require information on an area-wide basis to provide the users with a complete view of the regional traffic picture.

Interactive Traveler Information

This market package provides tailored information in response to a traveler request. The user can request and obtain current information regarding traffic conditions, transit services, traveler services, ride share/ride match, parking management, and pricing information. A range of two-way wide-area wireless and wireline communications systems may be used to support the required digital communications between traveler and the information service provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en-route to include phone, kiosk, Personal Digital Assistant, home computer, and a variety of in-vehicle devices. Successful deployment of this market package relies on availability of real-time transportation data from expressway and other roadway instrumentation, probe vehicles or other means.

Autonomous Route Guidance

This market package relies on in-vehicle sensory, location determination, computational, map database, and interactive driver interface equipment to enable route planning and detailed route guidance based on static, stored information. No communication with the infrastructure is assumed or required. Identical capabilities are available to the traveler outside the vehicle by integrating a similar suite of equipment into portable devices.

Dynamic Route Guidance

This market package offers the user advanced route planning and guidance, which is responsive to current conditions. The package combines the autonomous route guidance user equipment with a digital receiver capable of receiving real-time traffic, transit, and road condition information which is considered by the user equipment in provision of route guidance.

ISP-Based Route Guidance

This market package moves the route planning function from the user device to the information service provider. This approach simplifies the user equipment requirements and can provide better information to the traveler information and traffic management infrastructure components on which to predict future traffic and appropriate control strategies. The package includes two way data communications and optionally equips the vehicle with the databases, location determination capability, and display technology to support turn by turn route guidance.

Integrated Transportation Management/Route Guidance

This market package allows a traffic management center to continuously optimize the traffic control strategy based on “near-real time” information on intended routes for a proportion of the vehicles within their network. It represents an extension to the ISP-Based Route Guidance market package, which improves the level of coordination between ISP and Traffic Management Subsystem so that the planned routes can be factored in to near-future traffic management strategies. It would utilize the individual and ISP route planning information to optimize signal timing while at the same time providing updated signal timing information to allow optimized route plans. The use of predictive link times for this market package are possible through utilizing the market package--Traffic Prediction and Demand Management--at the traffic management center.

Yellow Pages and Reservation

This market package enhances the Interactive Traveler Information market package by adding yellow pages and reservation capabilities provided by a centralized traveler information system “infrastructure.” This centralized capability provides for easier update and modification of the yellow page and reservation system. The same basic user equipment is included; service or advertising fees should allow recovery of the ISP investment. This market package provides different ways for accessing information, either while en-route in a vehicle, pre-trip via wireline connections, etc.

Dynamic Ridesharing

This market package enhances the Interactive ATIS package by adding infrastructure provided (via a central server system instead of an on-board processing system) dynamic ridesharing capability. The investment to the driver or traveler should not increase. If this service is provided by a private ISP, service fees may be required to allow for recovery of the ISP investment.

In Vehicle Signing

This market package supports distribution of advisory information to drivers through in-vehicle devices regarding expressway road conditions and status. It includes short-range communications to the vehicle and wireline connections to the traffic management subsystem for coordination and control. This market package includes information distribution to inform the

driver of both highway-highway and highway-rail intersection status. This market package is applicable to all types of vehicles, private, commercial, transit, and emergency.

1.3.4 Advanced Vehicle Safety Systems Market Packages

Vehicle Safety Monitoring

This market package will diagnose critical components of the vehicle and warn the driver of potential dangers. On-board sensors will determine the vehicle's condition and performance, determine on-board safety data and display information.

Driver Safety Monitoring

This market package will determine the driver's condition, and warn the driver of potential dangers. On-board sensors will determine the driver's condition and performance, determine on-board safety data and display information.

Longitudinal Safety Warning

This market package allows for longitudinal warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas in front of and behind the vehicle and present warnings to the driver about potential hazards.

Lateral Safety Warning

This market package allows for lateral warning. It utilizes safety sensors and collision sensors. It requires on-board sensors to monitor the areas to the sides of the vehicle and present warnings to the driver about potential hazards.

Intersection Safety Warning

This market package will determine the probability of a collision in an equipped intersection (either highway-highway or highway-rail) and provide timely warnings to drivers in response to hazardous conditions. Monitors in the roadway infrastructure are needed to assess vehicle locations and speeds near an intersection. Using this information, a warning is determined and communicated to the approaching vehicle using a short-range communications system. Information can be provided to the driver through the market package--In-Vehicle Signing.

Pre-Crash Restraint Deployment

This market package provides in-vehicle sensors to monitor the vehicle's local environment, determine collision probability and deploy a pre-crash safety system. It will include on-board sensors to measure lateral and longitudinal gaps and together with weather and roadway conditions will determine lateral and longitudinal collision probability. It will have the mechanism to deploy a pre-crash safety system.

Driver Visibility Improvement

This market package will enhance driver visibility using an enhanced vision system. On-board display hardware is needed.

Advanced Vehicle Longitudinal Control

This market package automates the speed and headway control functions on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the throttle and brakes. It requires on-board sensors to measure longitudinal gaps and a processor for controlling the vehicle speed.

Advanced Vehicle Lateral Control

This market package automates the steering control on board the vehicle. It utilizes safety sensors and collision sensors combined with vehicle dynamics processing to control the steering. It requires on-board sensors to measure lane position and lateral deviations and a processor for controlling the vehicle steering.

Intersection Collision Avoidance

This market package will determine the probability of an intersection collision and provide timely warnings to approaching vehicles so that avoidance actions can be taken. This market package builds on the Intersection Collision Warning infrastructure and in-vehicle equipment and adds equipment in the vehicle that can take control of the vehicle in emergency situations. The same monitors in the roadway infrastructure are needed to assess vehicle locations and speeds near an intersection. This information is determined and communicated to the approaching vehicle using a short-range communications system. The vehicle uses this information to develop control actions, which alter the vehicle's speed and steering control and potentially activate its pre-crash safety system.

Automated Highway System

This market package enables "hands-off" operation of the vehicle on the automated portion of the highway system. Implementation requires lateral lane holding, vehicle speed and steering control, and Automated Highway System check-in and checkout. This market package currently supports a balance in intelligence allocation between infrastructure and the vehicle pending selection of a single operational concept by the AHS consortium. The role of partners in the AMATS's region, in this market package would be focused on infrastructure enhancements to facilitate deployment of an automated highway system.

1.3.5 Emergency Management Market Packages

Emergency Response

This market package automates emergency vehicle notification upon verification of the location and nature of an incident by the Emergency Management subsystem. This package uses existing and emerging wireline interconnects to sensors, and vehicle position locators for incident detection. Coordination between Emergency Management Subsystems supports emergency notification and coordinated response between agencies. Existing wide area wireless communications would be utilized between the Emergency Management subsystem and an emergency vehicle enabling coordination with the emergency fleet. The Emergency Management Center would include hardware and software for tracking the emergency vehicles. Law enforcement would normally be an integral part of this package as well, processing violation notifications and supporting incident clearing efforts.

Emergency Routing

This market package supports dynamic routing of emergency vehicles and coordination with the Traffic Management subsystem for special priority on the selected route(s). The ISP provides the route planning function for the emergency fleet based on real-time traffic conditions and the emergency routes assigned to other responding vehicles. Also, the Emergency vehicle would optionally be equipped with dedicated short-range communications for local signal coordination on arterial streets.

Mayday Support

This package allows the user (driver or non-driver) to initiate a request for emergency assistance and enables the Emergency Management Subsystem to locate the user and determine the appropriate response. The Emergency Management Subsystem may be operated by the public sector or by a private sector provider. The request from the traveler needing assistance may be manually initiated or automated and linked to vehicle sensors. The data is sent to the Emergency Management subsystem using wide area wireless communications with voice as an option. Providing user location implies either a location technology within the user device or location determination within the communications infrastructure. The role for partners in the AMATS's region, in this market package would be focused on infrastructure enhancements to facilitate the provision of emergency call boxes, buttons, or some kind of mayday system on the expressway which allows the users to interact with an operator during emergency situations.

1.3.6 Archived Data Market Packages

ITS Data Mart

This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy, and meta data management common to all ITS archives and provides general query and report access to archive data users.

ITS Data Warehouse

This market package includes all the data collection and management capabilities provided by the ITS Data Mart, and adds the functionality and interface definitions that allow collection of data from multiple agencies and data sources spanning across modal and jurisdictional boundaries. It performs the additional transformations and provides the additional meta data management features that are necessary so that all this data can be managed in a single repository with consistent formats. The potential for large volumes of varied data suggests additional on-line analysis and data mining features that are also included in this market package in addition to the basic query and reporting user access features offered by the ITS Data Mart.

ITS Virtual Data Warehouse

This market package provides the same broad access to multi-modal, multi-dimensional data from varied data sources as in the ITS Data Warehouse Market Package, but provides this access using enhanced interoperability between physically distributed ITS archives that are each locally managed. Requests for data that are satisfied by access to a single repository in the ITS Data Warehouse Market Package are parsed by the local archive and dynamically translated to requests to remote archives which relay the data necessary to satisfy the request.

1.3.7 Commercial Vehicle Operations Market Packages

Freight Administration

This market package tracks cargo location and condition. This information is communicated with the Fleet and Freight Management Center via the existing wireless infrastructure. Interconnections are provided to intermodal freight shippers for tracking cargo across modes as it travels from source to destination.

Fleet Administration

This market package tracks cargo and the cargo condition. This information is communicated with the Fleet and Freight Management Subsystem via the existing wireless infrastructure. Interconnections are provided to intermodal shippers and intermodal freight depots for tracking the cargo from source to destination.

Electronic Clearance

This market package provides for automated clearance at roadside check facilities. The roadside check facility communicates with the Commercial Vehicle Administration subsystem over wireline to retrieve infrastructure snapshots of critical carrier, vehicle, and driver data to be used to sort passing vehicles. This package allows a good driver/ vehicle/carrier to pass roadside facilities at highway speeds using transponders and dedicated short-range communications to the roadside. The roadside check facility may be equipped with AVI, weighing sensors, transponder read/write devices, computer workstation processing hardware, software, and databases.

CV Administrative Processes

This market package provides for electronic application, processing, fee collection, issuance, and distribution of CVO credential and tax filing. Through this process, carriers, drivers, and vehicles may be enrolled in the electronic clearance program provided by a separate market package which allows commercial vehicles to be screened at mainline speeds at commercial vehicle check points. Through this enrollment process, current profile databases are maintained in the Commercial Vehicle Administration Subsystem and snapshots of this database are made available to the commercial vehicle check facilities at the roadside to support the electronic clearance process.

International Border Electronic Clearance

This market package provides for automated clearance specific to international border crossings. This package augments the electronic clearance package by allowing interface with customs related functions and permitting NAFTA required entry and exit from the US to Canada and Mexico.

Weigh-In-Motion

This market package provides for high speed weigh-in-motion with or without AVI attachment. Primarily this market package provides the roadside with additional equipment, either fixed or removable. If the equipment is fixed, then it is thought to be an addition to the electronic clearance and would work in conjunction with the AVI and AVC equipment in place.

Roadside CVO Safety

This market package provides for automated roadside safety monitoring and reporting. It automates commercial vehicle safety inspections at the Commercial Vehicle Check roadside element. The capabilities for performing the safety inspection are shared between this market package and the On-Board CVO Safety Market Package, which enables a variety of implementation options. The basic option, directly supported by this market package, facilitates safety inspection of vehicles that have been pulled in, perhaps as a result of the automated screening process provided by the Electronic Clearance Market Package. In this scenario, only basic identification data and status information is read from the electronic tag on the commercial vehicle. The identification data from the tag enables access to additional safety data maintained in the infrastructure which is used to support the safety inspection, and may also inform the pull-in decision if system timing requirements can be met. More advanced implementations, supported by the On-Board CVO Safety market package, utilize additional vehicle safety monitoring and reporting capabilities in the commercial vehicle to augment the roadside safety check.

On-board CVO Safety

This market package provides for on-board commercial vehicle safety monitoring and reporting. It is an enhancement of the Roadside CVO Safety market package and includes roadside support for reading on-board safety data via tags. This market package uses the same communication links as the Roadside CVO Safety market package, and provides the commercial vehicle with a cellular link (data and possibly voice) to the Fleet and Freight Management and the Emergency Management Centers. Safety warnings are provided to the driver as a priority with secondary requirements to notify the Fleet and Freight Management and Commercial Vehicle Check roadside elements.

CVO Fleet Maintenance

This market package supports maintenance of CVO fleet vehicles through close interface with on-board monitoring equipment and AVLS capabilities within the Fleet and Freight Management Subsystem. Records of vehicle mileage, repairs, and safety violations are maintained to assure safe vehicles on the highway.

HAZMAT Management

This market package integrates incident management capabilities with commercial vehicle tracking to assure effective treatment of HAZMAT material and incidents. HAZMAT tracking is performed by the Fleet and Freight Management Subsystem. The Emergency Management subsystem is notified by the Commercial Vehicle if an incident occurs and coordinates the response. The response is tailored based on information that is provided as part of the original incident notification or derived from supplemental information provided by the Fleet and Freight Management Subsystem. The latter information can be provided prior to the beginning of the trip or gathered following the incident depending on the selected policy and implementation.

1.4 Selection And Prioritization Of User Services And Market Packages

Several methods were employed to define and prioritize user services and market packages. Initially meetings were held with various ITS stakeholder agencies in an attempt to document primary existing transportation system deficiencies relative to these agencies and within the Shreveport/Bossier City region. The transportation system was also analyzed based on the *Congestion System Management Plan* and *Long Range Transportation Plan Update* and transportation deficiencies were documented.

These deficiencies were then modified to operational objective statements. User services, which most effectively address these stated deficiencies/operational objectives, were then identified. Market packages were then related to the identified user service using the *User Service to Market Package Relationship Matrix* documented in the National ITS Architecture.

The following **Table B.3** relates identified transportation issues/needs to user services and market packages.

Table B.3 Relationship Between Primary Transportation Issues, Operational Objectives, User Services and Market Packages

Primary Transportation Issue	Operational Objectives Associated with Transportation Issues	Associated Primary User Services	Related Primary Market Packages
<ul style="list-style-type: none"> Interstate Congestion/Capacity Deficiencies Arterial Capacity Deficiency Outdated/Antiquated Surface Street Control System in Shreveport Lack of real-time Traveler Information Ability to Quickly Detect, Locate and Verify Incidents, Incident Management Training Inter-Agency Coordination and Operation of Surface Street Control System Centralized Control and Management of Transportation System Bicyclists and Pedestrians 	<p>Provide central control, management, and surveillance of the regional transportation system with improved coordination and data sharing among involved agencies as well as improved dissemination of traffic information to travelers.</p>	<ul style="list-style-type: none"> Traffic Control En-route Driver Information Incident Management 	<ul style="list-style-type: none"> Network Surveillance Traffic Information Dissemination Broadcast Traveler Information Surface Street Control Freeway Control Incident Management Road Weather Information System
<ul style="list-style-type: none"> Interstate Congestion/Capacity Deficiencies Emissions and Air Quality 	<p>Improve traffic flow and travel time on the interstate system to increase efficiency, improve air quality, and reduce delay.</p>	<ul style="list-style-type: none"> Incident Management En-route Drive Information Traffic Control Pre-trip Travel Information Emissions Testing and Mitigation 	<ul style="list-style-type: none"> Network Surveillance Freeway Control Traffic Information Dissemination Incident Management Regional Traffic Control Emissions Monitoring and Management Road Weather Information System
<ul style="list-style-type: none"> Arterial Capacity Deficiency Outdated/Antiquated Surface Street Control System in Shreveport Inter-Agency Coordination and Operation of Surface Street Control System Emissions and Air Quality 	<p>Improve traffic flow and travel time on the arterial street system to increase efficiency, improve air quality, and reduce delay</p>	<ul style="list-style-type: none"> Traffic Control Incident Management En-route Driver Information Pre-trip Travel Information Emissions Testing and Mitigation 	<ul style="list-style-type: none"> Network Surveillance Surface Street Control Traffic Information Dissemination Incident Management Emissions Monitoring and Management Road Weather Information System

Table B.3 Relationship Between Primary Transportation Issues, Operational Objectives, User Services and Market Packages

Primary Transportation Issue	Operational Objectives Associated with Transportation Issues	Associated Primary User Services	Related Primary Market Packages
<ul style="list-style-type: none"> ▪ Lack of real-time Traveler Information ▪ Construction Zone Safety and Congestion 	Help to reduce travel time and improve travel time predictability by providing real time information to travelers regarding incidents, congestion, construction zones, and transit schedule arrivals so travelers can make more informed decisions regarding route selection and transit usage	<ul style="list-style-type: none"> ▪ Pre-trip Travel Information ▪ En-route Driver Information ▪ Public Transportation Management ▪ Maintenance and Construction Operations 	<ul style="list-style-type: none"> ▪ Network Surveillance ▪ Traffic Information Dissemination ▪ Broadcast Traveler Information ▪ Transit Vehicle Tracking ▪ Road Weather Information System
<ul style="list-style-type: none"> ▪ Interstate Congestion/Capacity Deficiencies ▪ Bridge Capacity and System Linkage ▪ Effects of Incidents/Non-Recurring Congestion/Incident Management ▪ Ability to Quickly Detect, Locate and Verify Incidents, Incident Management Training ▪ Construction Zone Safety and Congestion ▪ Communications among Emergency Management Agencies 	Minimize congestion and delay impacts of incidents, accidents and construction on the interstate system and critical transportation links such as the Mississippi River Bridge crossings	<ul style="list-style-type: none"> ▪ Incident Management ▪ Emergency Notification and Personnel Security ▪ Emergency Vehicle Management ▪ Maintenance and Construction Operations 	<ul style="list-style-type: none"> ▪ Network Surveillance ▪ Incident Management ▪ Emergency Response ▪ Emergency Routing ▪ Road Weather Information System
<ul style="list-style-type: none"> ▪ Effects of Incidents/Non-Recurring Congestion/Incident Management ▪ Ability to Quickly Detect, Locate and Verify Incidents, Incident Management Training ▪ Communications among Emergency Management Agencies 	Reduce clearance time for accidents and incidents to minimize non-recurring congestion and delay and reduce the probability of secondary accidents associated with the initial incident.	<ul style="list-style-type: none"> ▪ Incident Management ▪ Emergency Notification and Personal Security ▪ Emergency Vehicle Management 	<ul style="list-style-type: none"> ▪ Incident Management ▪ Emergency Response ▪ Emergency Routing ▪ May Day Support
<ul style="list-style-type: none"> ▪ Security on Transit Buses ▪ Fleet Management/AVL 	Improve transit security by improving surveillance and monitoring of transit vehicles and facilities.	<ul style="list-style-type: none"> ▪ Public Travel Security ▪ Public Transportation Management 	<ul style="list-style-type: none"> ▪ Transit Security ▪ Transit Vehicle Tracking

Table B.3 Relationship Between Primary Transportation Issues, Operational Objectives, User Services and Market Packages

Primary Transportation Issue	Operational Objectives Associated with Transportation Issues	Associated Primary User Services	Related Primary Market Packages
<ul style="list-style-type: none"> ▪ Lack of real-time Traveler Information ▪ Lack of real-time Information/Status to Transit Users ▪ Fleet Management/AVL 	Improve transit service by making available to transit users and transit operators real time information / status regarding schedule adherence and arrivals to allow for more effective use of transit.	<ul style="list-style-type: none"> ▪ Public Transportation Management ▪ En-Route Transit Information 	<ul style="list-style-type: none"> ▪ Transit Vehicle Tracking ▪ Demand Response Transit Operations ▪ Transit Fixed Route Operations
<ul style="list-style-type: none"> ▪ Delay and Safety at Highway/Rail Grade Crossings 	Reduce delays and reduce accidents/accident severity at highway-railroad grade crossings by improving detection and warning systems.	<ul style="list-style-type: none"> ▪ Highway-Rail Intersection 	<ul style="list-style-type: none"> ▪ Standard Railroad Grade Crossing ▪ Enhanced Railroad Grade Crossing ▪ Railroad Operations Coordination

Table B.4 highlights recommended user services and *Table B.5* identifies recommended market packages for deployment within the Shreveport/Bossier City region.

Table B.4 Shreveport/Bossier Regional Primary User Services

User Services Bundle	User Services
Travel and Transportation Management	<ul style="list-style-type: none"> • En-Route Driver Information • Route Guidance • Traveler Services Information • Traffic Control • Incident Management • Emissions Testing and Mitigation • Demand Management and Operations • Pre-trip Travel Information • Ride Matching and Reservation • Highway-Rail Intersection • Maintenance and Construction Operations
Public Transportation Operations	<ul style="list-style-type: none"> • Public Transportation Management • En-Route Transit Information • Personalized Public Transit • Public Travel Security
Electronic Payment	<ul style="list-style-type: none"> • Electronic Payment Services
Commercial Vehicle Operations	<ul style="list-style-type: none"> • Commercial Vehicle Electronic Clearance • Automated Roadside Safety Inspection • On-board Safety Monitoring • Commercial Vehicle Administration Processes • Hazardous Materials Incident Response • Freight Mobility
Emergency Management	<ul style="list-style-type: none"> • Emergency Notification and Personal Security • Emergency Vehicle Management
Advanced Vehicle Safety Systems	<ul style="list-style-type: none"> • Longitudinal Collision Avoidance • Lateral Collision Avoidance • Intersection Collision Avoidance • Vision Enhancement for Crash Avoidance • Safety Readiness • Pre-Crash Restraint Deployment • Automated Highway System
Information Management	<ul style="list-style-type: none"> • Archived Data Function

XXXXXXX = Primary User Services

Table B.5 Shreveport/Bossier Regional Primary Market Packages

Market Package Category	Market Package
Advanced Traffic Management Systems	<ul style="list-style-type: none"> • Network Surveillance • Probe Surveillance • Surface Street Control • Freeway Control • HOV Lane Management • Traffic Information Dissemination • Regional Traffic Control • Incident Management System • Traffic Forecast And Demand Management • Electronic Toll Collection • Emissions Monitoring And Management • Virtual TMC And Smart Probe Data • Standard Railroad Grade Crossing • Advanced Railroad Grade Crossing • Railroad Operations Coordination • Parking Facility Management • Reversible Lane Management • Road Weather Information System • Regional Parking Management
Advanced Public Transportation Systems	<ul style="list-style-type: none"> • Transit Vehicle Tracking • Transit Fixed-Route Operations • Demand Response Transit Operations • Transit Passenger And Fare Management • Transit Security • Transit Maintenance • Multi-Modal Coordination • Transit Traveler Information
Advanced Traveler Information Systems	<ul style="list-style-type: none"> • Broadcast Traveler Information • Interactive Traveler Information • Autonomous Route Guidance • Dynamic Route Guidance • ISP Based Route Guidance • Integrated Transportation Management / Route Guidance • Yellow Pages And Reservation • Dynamic Riderssharing • In-Vehicle Signing

Table B.5 Shreveport/Bossier Regional Primary Market Packages

Market Package Category	Market Package
Advanced Vehicle Safety Systems	<ul style="list-style-type: none"> • Vehicle Safety Monitoring • Driver Safety Monitoring • Longitudinal Safety Warning • Lateral Safety Warning • Intersection Safety Warning • Pre-Crash Restraint Deployment • Driver Visibility Improvement • Advanced Vehicle Longitudinal Control • Advanced Vehicle Lateral Control • Intersection Collision Avoidance • Automated Highway System
Emergency Management	<ul style="list-style-type: none"> • Emergency Response • Emergency Routing • Mayday Support
Archived Data	<ul style="list-style-type: none"> • ITS Data Mart • ITS Data Warehouse • ITS Virtual Data Warehouse
Commercial Vehicle Operations	<ul style="list-style-type: none"> • Fleet Administration • Freight Administration • Electronic Clearance • CV Administrative Processes • International Border Electronic Clearance • Weigh-In Motion • Roadside CVO Safety • On-Board CVO Safety • HAZMAT Management • CVO Fleet Maintenance

XXXXXXX

= Primary Market Packages

APPENDIX C

SHREVEPORT/BOSSIER CITY REGION INTERCONNECT AND ARCHITECTURE FLOW DIAGRAMS

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SHREVEPORT/BOSSIER CITY REGION INTERCONNECT AND ARCHITECTURE FLOW DIAGRAMS

1.1 Interconnect and Architecture Flow Diagrams

A graphical presentation of the regional ITS architecture for the Shreveport/Bossier City region is provided in **Figures C.1** through **C.9**. The figures consist of a series of “system-oriented” and “function-oriented” interconnect and architecture flow diagrams that illustrate the interactions between the high-level subsystems identified in the Shreveport/Bossier City Regional ITS Architecture. Detailed definitions of architecture flows included in the diagrams can be found in the National ITS Architecture CD-ROM or on the National ITS Architecture website (www.odetics.com/itsarch).

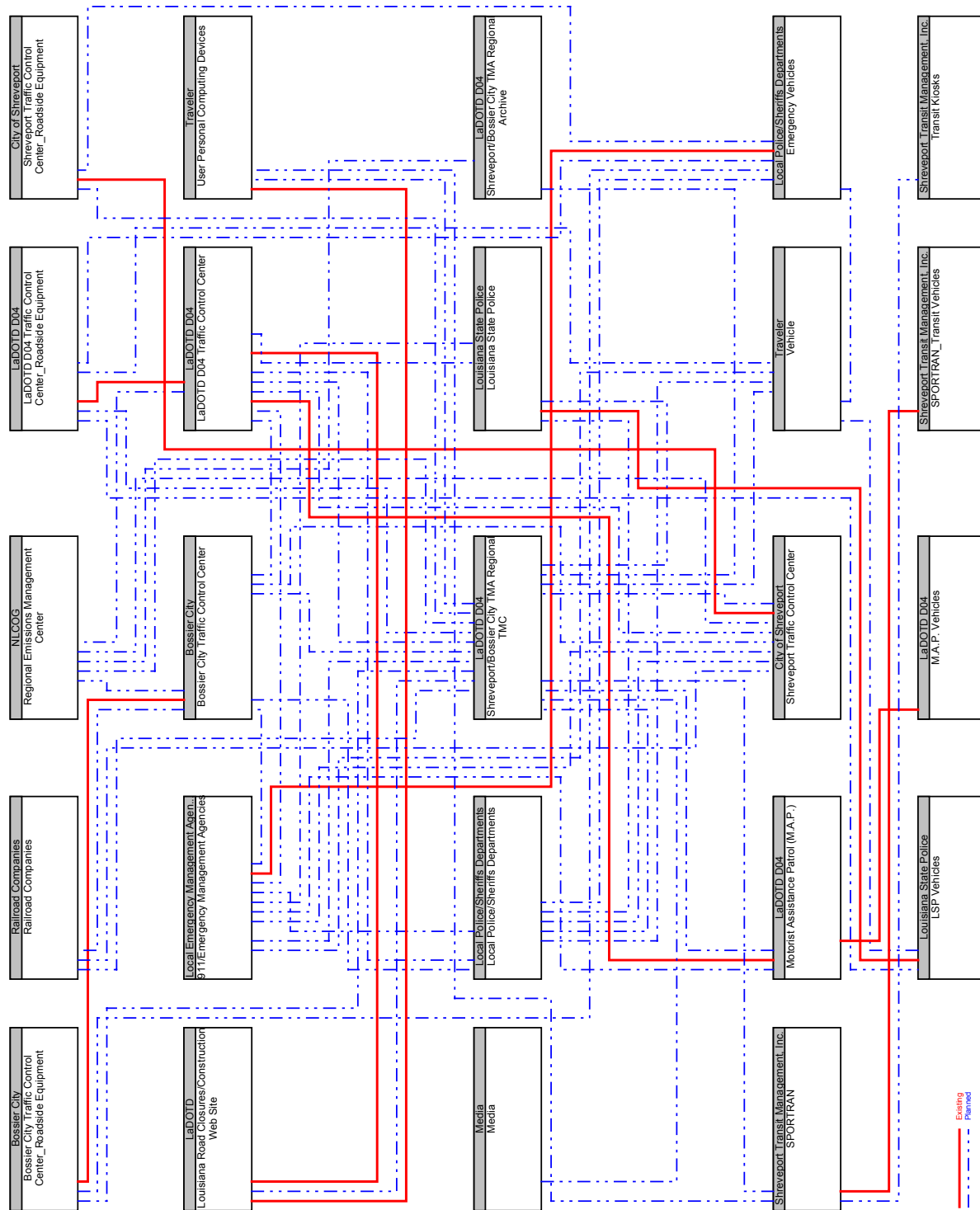


Figure C.1 Regional Architecture Interconnect Diagram

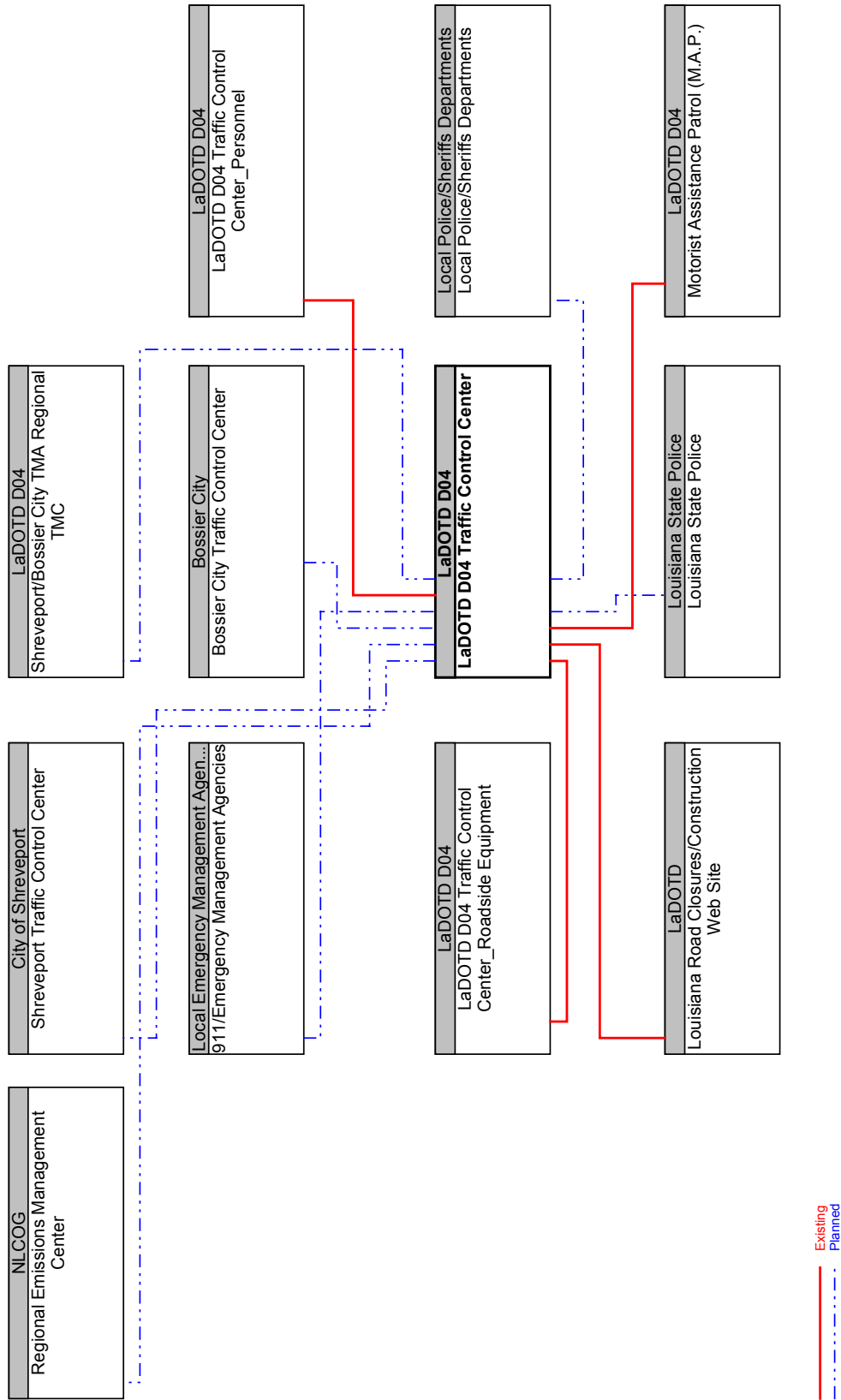


Figure C.2 Interconnect Diagram – DOTD District 04 Traffic Control Center

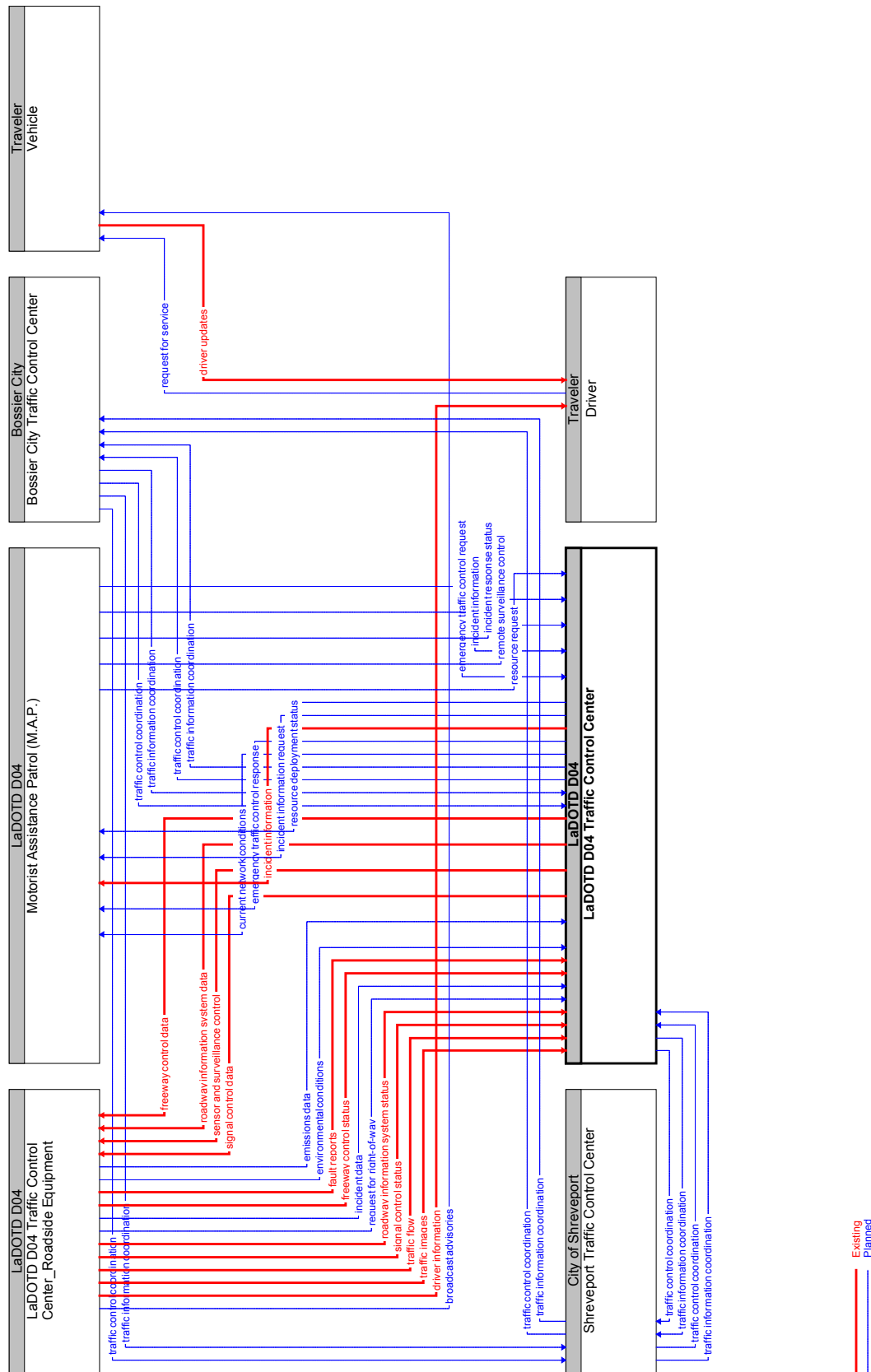


Figure C.3 Architecture Flow Diagram – DOTD District 04 Traffic Management

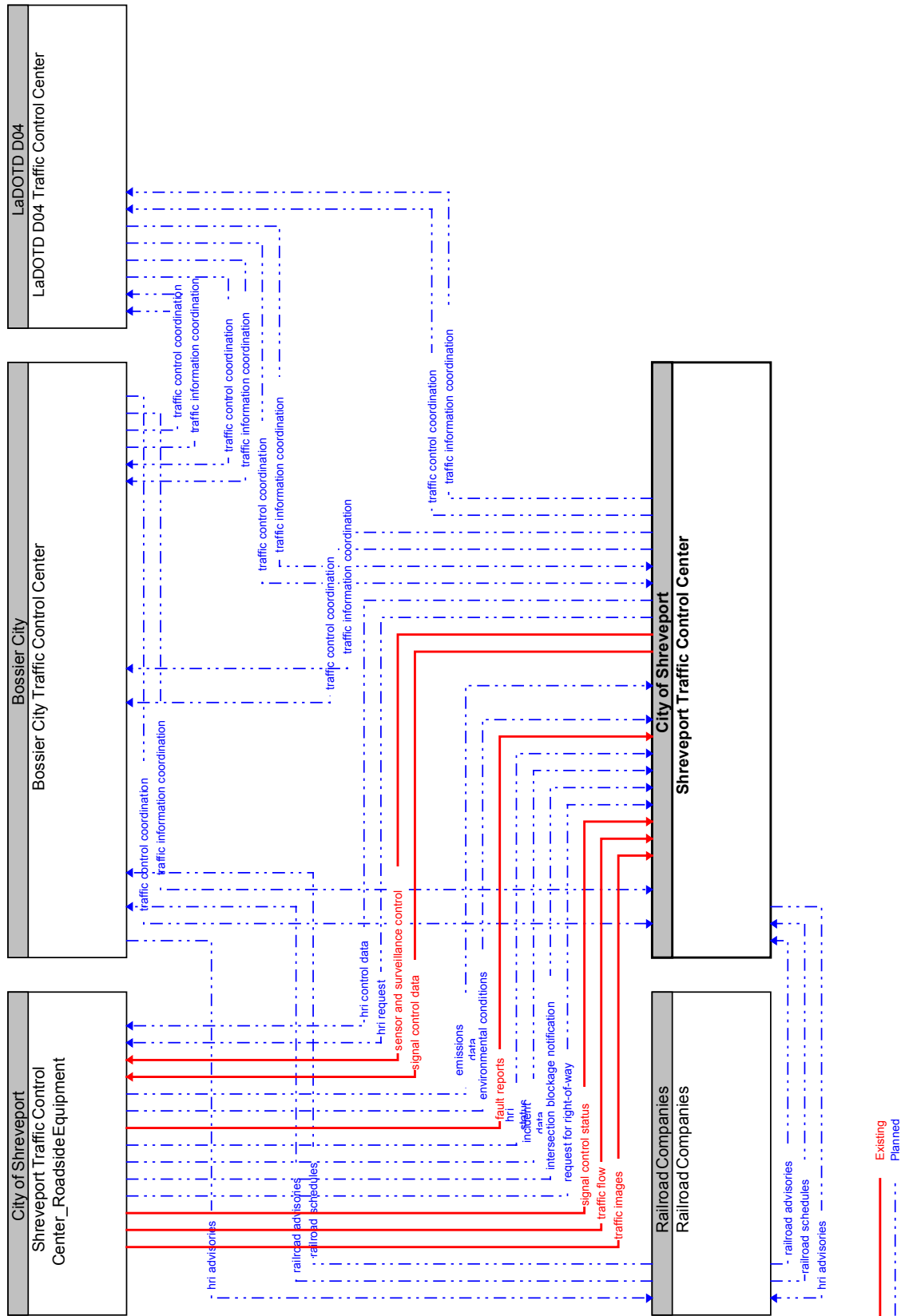


Figure C.4 Architecture Flow Diagram – City of Shreveport Traffic Management

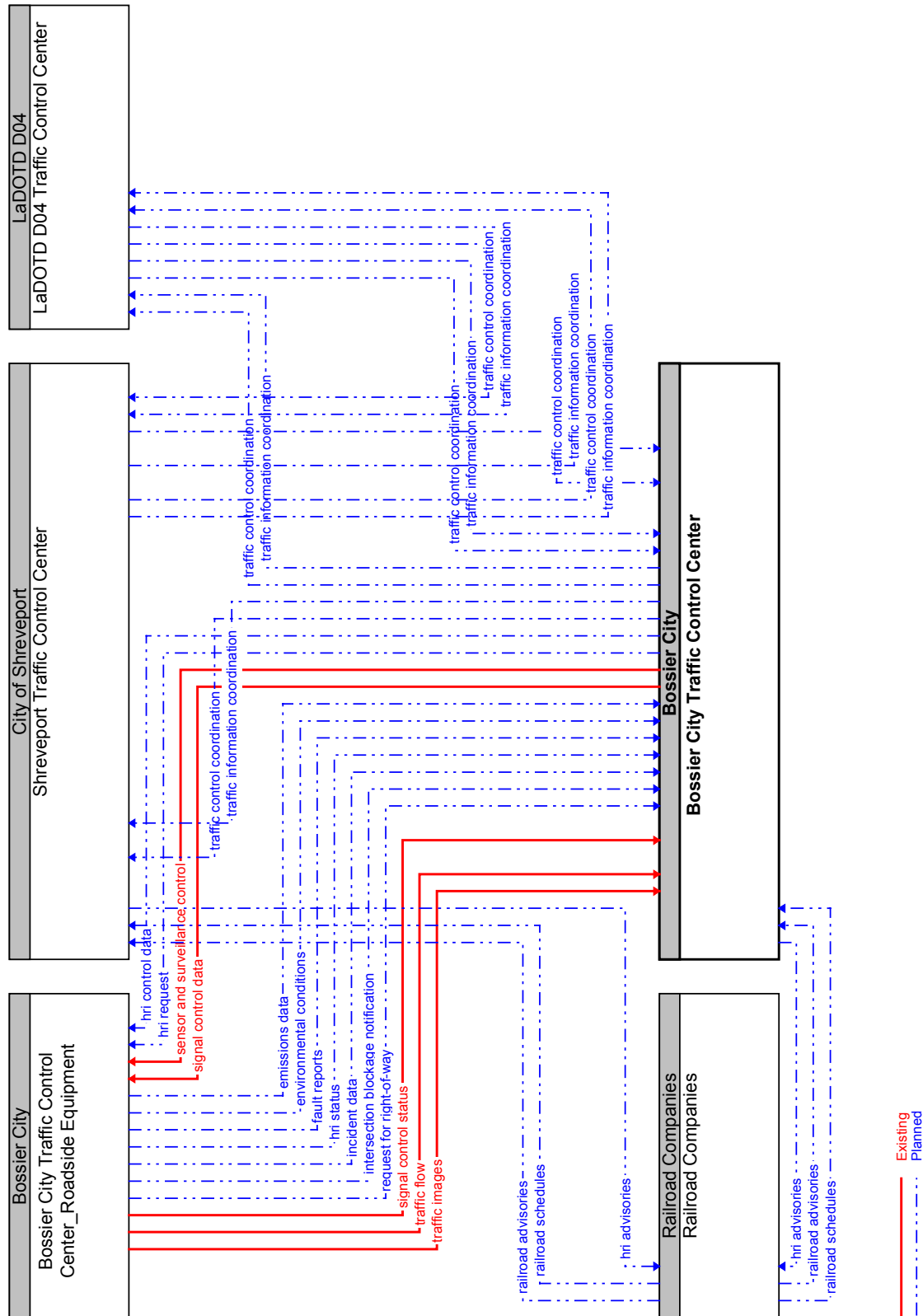


Figure C.5 Architecture Flow Diagram –Bossier City Traffic Management

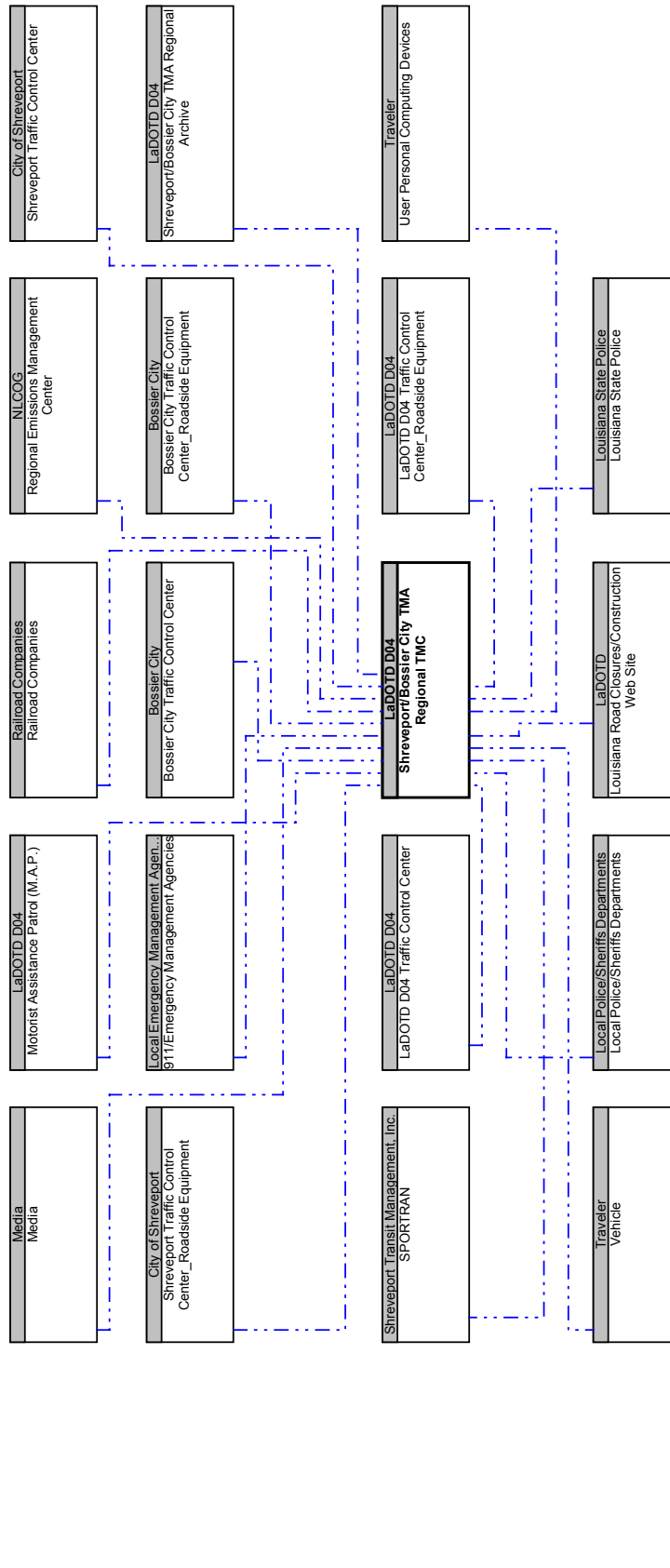


Figure C.6 Interconnect Diagram – Regional TMC

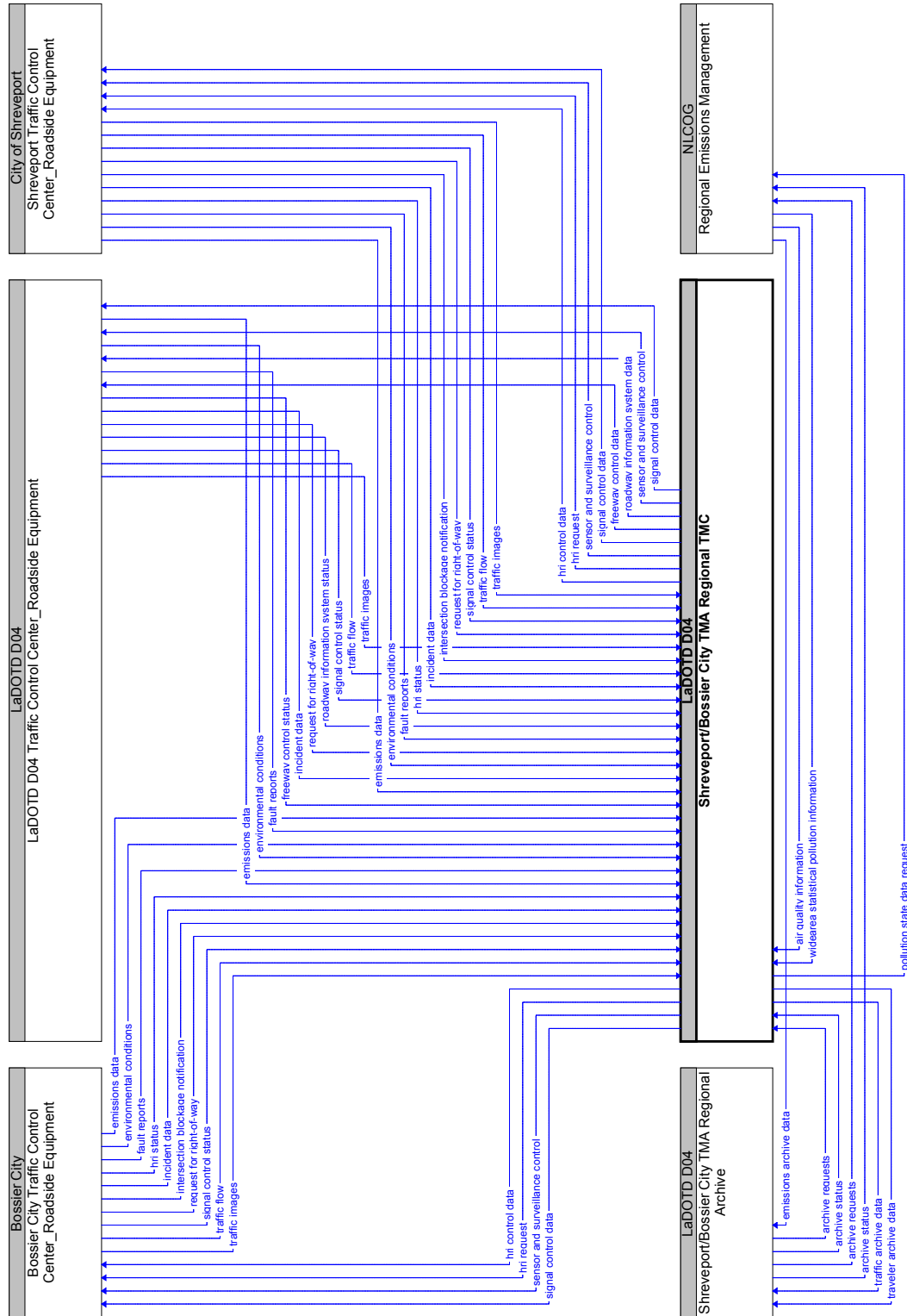


Figure C.7 Architecture Flow Diagram – Regional Traffic Management, Emissions Management and Archived Data

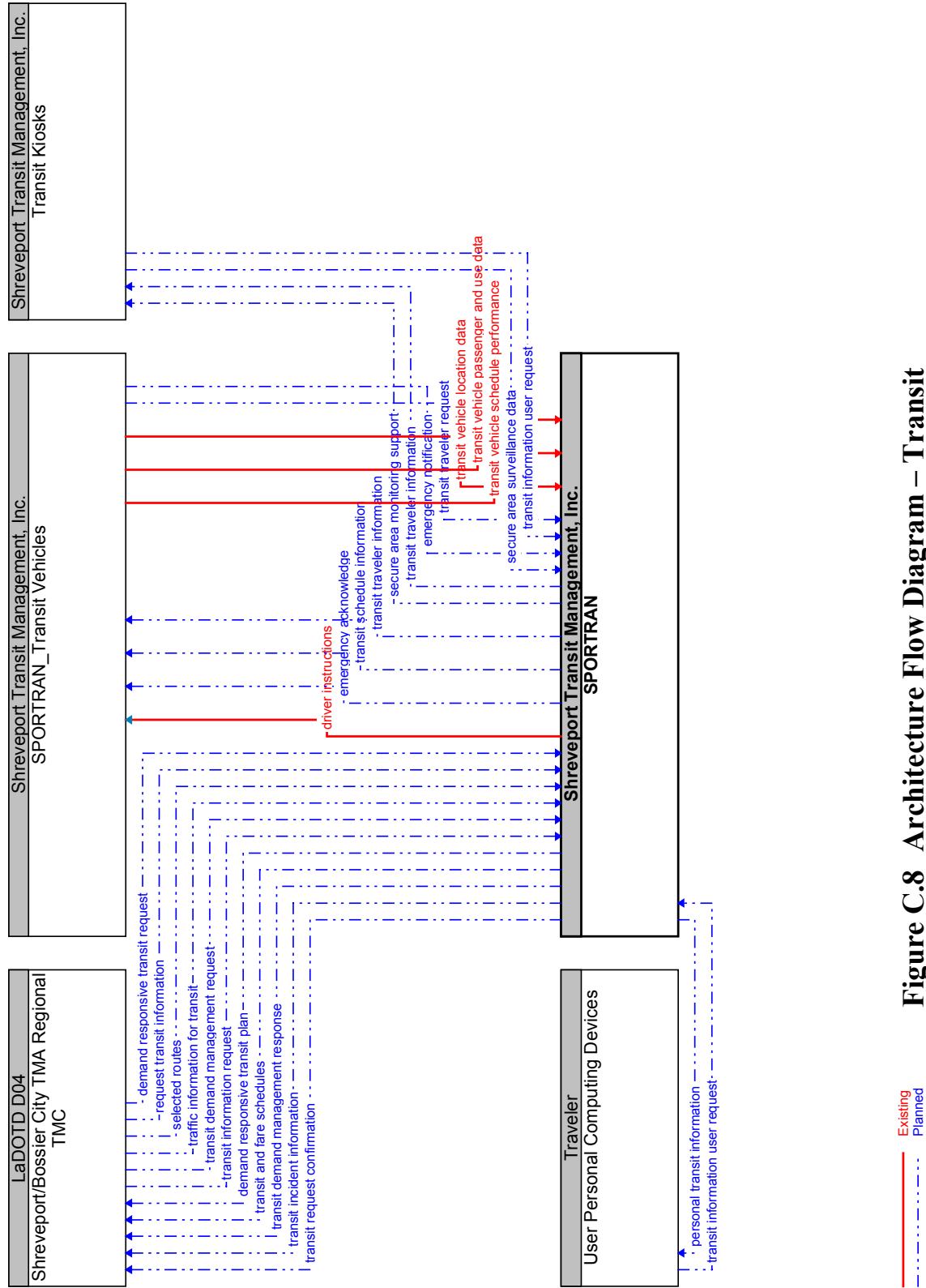


Figure C.8 Architecture Flow Diagram – Transit Management and Transit Traveler Information

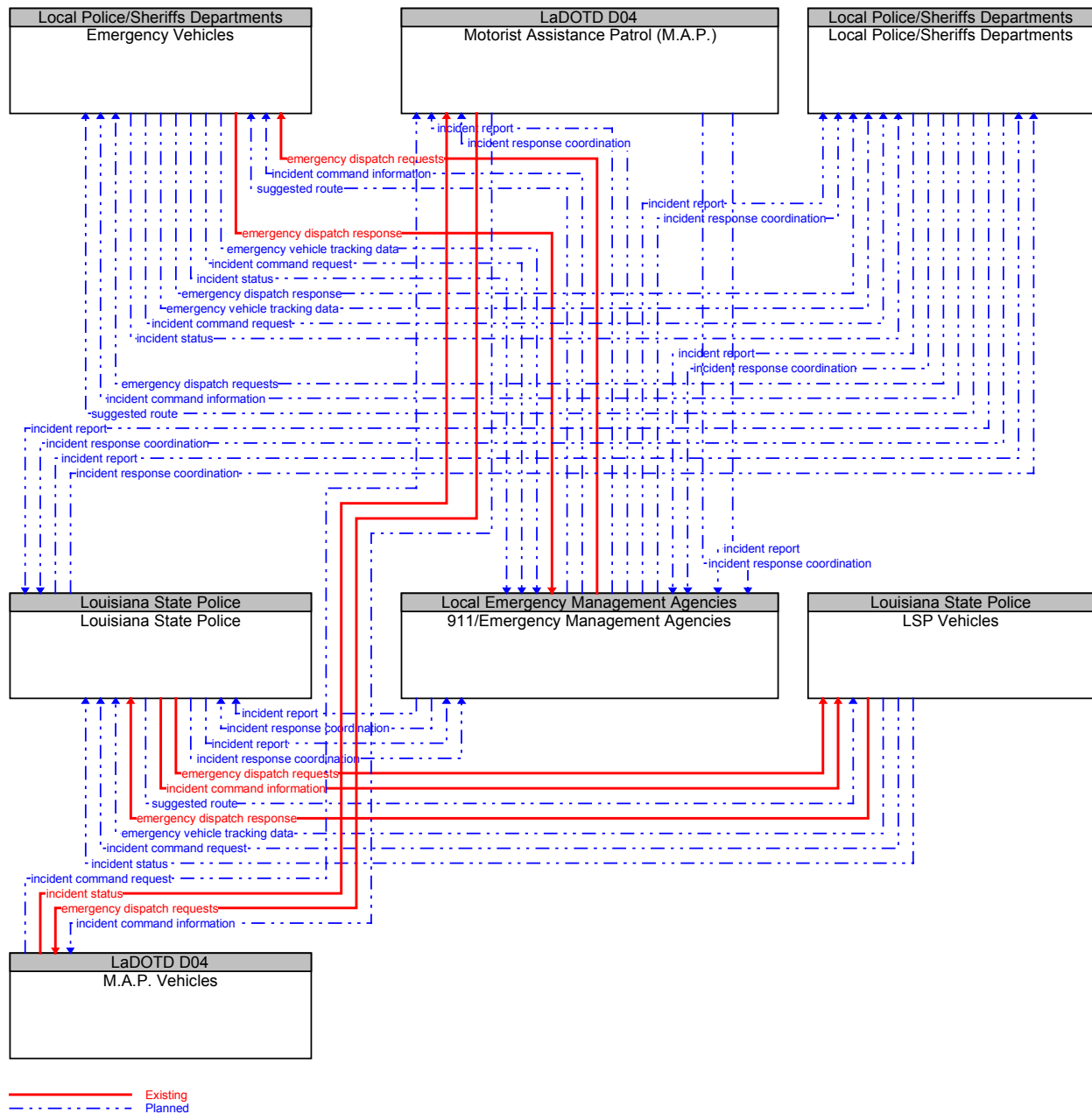


Figure C.9 Architecture Flow Diagram – Incident Management Subsystems

APPENDIX D

SUMMARY OF SELECTED STEPS IN A POSSIBLE REGIONAL ITS PROJECT ARCHITECTURE CONSISTENCY PROCESS

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SUMMARY OF SELECTED STEPS IN A POSSIBLE REGIONAL ITS PROJECT ARCHITECTURE CONSISTENCY PROCESS

The section of this report on system architecture identified the four basic steps in a possible regional process to insure that federally funded ITS projects are consistent with the Shreveport/Bossier City regional ITS architecture. This appendix further describes some of the steps in that process.

1.1 Determination of Federal Requirement Applicability

Is it an ITS Project? Section 940.3 of the FHWA ITS architecture and standards rule defines an ITS project as: “any project that in whole or in part funds the acquisition of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National ITS Architecture.” An alternative approach to this determination is to consider whether a given project includes ITS elements, with ITS being defined as “electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.”

A definitive and consistent interpretation of what constitutes an ITS project will only emerge through time and experience, as precedent is established. Although it should be expected that “reason will prevail”, a fairly broad interpretation should be expected. It is anticipated that a list of “exempted” transportation technology projects will emerge from national experience fairly quickly and will aid in interpretation at the local level.

Will the ITS project qualify for an exemption? There are some instances where even though a project uses funds from the Highway Trust Fund and it is an ITS project that the Policy may not be applicable. These exemptions and exceptions depend on when the ITS systems that are involved became operational and the amount/type of change the project introduces. They are shown in **Table D.1**.

Table D.1 Exemptions and Exceptions to Policy Requirements

Date	Type	Exemption / Exception
Systems in existence on 9 June 1998 ¹	Operations and Maintenance of ITS	All Policy Provisions
Systems in existence on 9 June 1998 ¹	Upgrades and Expansions of Existing ITS	U.S. Secretary of Transportation authorized Exemptions if: <ul style="list-style-type: none"> • Consistent with goals of TEA-21 Subtitle C on ITS • Within usable life of ITS components being modified • Is cost effective compared to options that will meet conformity
Systems in Final Design on 8 April 2001	All ITS components	Section VI Policy requirements on Project Implementation: <ul style="list-style-type: none"> • Systems Engineering Analysis • Major ITS Project Architectures.
Proposed Systems	Research Projects to meet TEA-21 Section 5204	U.S. Secretary of Transportation authorized Exemptions

¹ Date of TEA-21 Enactment

Source: “*FTA National ITS Architecture Consistency Policy for Transit Projects – Working Document*”, October 2, 2001, Federal Transit Administration, pg. 11.

The FHWA and FTA will determine exemptions/exceptions on a case by case basis. If it is the determination of the grantee and the MPO/DOTD that the project qualifies for an exemption/exception, they must consult with the FTA or FHWA regional ITS contact to determine the level of justification required and to obtain the U.S. Secretary of Transportation authorization.

Will Highway Trust Funds be used? The rule/policy applies to all ITS projects using Highway Trust Funds, which includes the Mass Transit Account and virtually all other funds distributed by the FHWA and FTA, including (pg. 9, “*FTA National ITS Architecture Consistency Policy for Transit Projects – Working Document*”, October 2, 2001, Federal Transit Administration):

FHWA grant program

- ITS Deployment Program (Earmarks)
- Congestion Mitigation and Air Quality
- Surface Transportation Program
- National Highway System
- Interstate Maintenance Program
- Federal Lands Program

FTA grant programs

- USC 5303 Metropolitan Planning
- USC 5313 State Planning & Research
- USC 5314 National Planning & Research
- USC 5307 Urbanized Area Formula
- USC 5311 Non-urbanized Area Formula
- USC 5312 Research Development & Demonstration
- USC 5309 Capital Program
- New Starts
- Fixed Guideway Modernization
- Bus and Bus Related Facilities
- USC 5310 Elderly/Persons with Disabilities
- TEA-21 3037 Job Access

Other federal program funds may, or may not, come from the Highway Trust Fund. If a grantee uses other federal funds, and no funds from the above it is recommended that the grantee consult with the federal Agency administering the program in question to verify if Highway Trust Funds are/are not used.

1.2 Project Inclusion in the Regional Architecture

In addition to the applicability of the rule/policy, the planning consultation with a MPO/DOTD would determine whether the ITS project is included in the regional architecture, and if not, whether the regional architecture, or the project, should be revised. Neither the FHWA nor the FTA has provided specific guidance to support the determination of a project's consistency with a regional architecture, leaving this determination to the regional stakeholders. This determination could begin with the identification of which ITS market packages would be implemented through the project and whether these market packages are included in the regional architecture.

The Shreveport/Bossier City regional architecture is fairly extensive, and includes a very wide range of ITS elements. Therefore, it is not likely that a project concept would be found to be “inconsistent” with the regional architecture per se. Rather, it is more likely that the project specific details and concept may not be reflected in the higher-level regional architecture at all. In either case, the project sponsor and MPO/DOTD would work together to modify the architecture and/or adjust the project as necessary to reach consensus on project-architecture consistency.

The ability to *modify the regional architecture to accommodate a particular project* is a critical feature of the federal ITS requirements, and one that should address many of the potential concerns of project sponsors.

1.3 Approach to Systems Engineering Analysis

The rule/policy requires that ITS projects must undergo a “systems engineering analysis”, which is a structured process for arriving at a final design of a system, and that the scale of the analysis should “be on a level commensurate with the project scope”. The systems engineering analysis evaluates a number of alternatives for the configuration of the ITS and communications systems associated with the project and ways to meet the design objectives considering total life-cycle

costs, technical merit and reliability, and relative value of each option. It also helps identify risks and develop contingencies to overcome them.

During the planning level consultation with the MPO/DOTD, the project sponsor should work with the MPO/DOTD to determine what level of analysis is necessary, referencing each of the required steps in the analysis. An overall plan for the analysis should be sketched out including a preliminary identification of what agencies may need to participate in the analysis.

Guidance and considerations relative to some of the major steps in the systems engineering process are presented in *Table D.2*.

1.4 Development of Federal Grant Application and Supporting Documentation

The MPO/DOTD would support grantee's efforts to produce the documentation necessary, as part of the federal funding grant application, to demonstrate compliance with the rule/policy. The rule/policy does not specify the type of documentation required to demonstrate project compliance. The FTA published a "working document" version of guidance for project compliance that does include some discussion of documentation procedures, within the context of existing FTA grant processes ("FTA National ITS Architecture Consistency Policy for Transit Projects – Working Document", October 2, 2001, Federal Transit Administration). That document also references a separate memorandum describing capturing ITS projects within the FTA Transportation Electronic Award Management system. No equivalent guidance is currently available from the FHWA. The Shreveport/Bossier City MPO and/or the DOTD may consider development of standard rule/policy compliance forms.

1.5 Verification of Systems Engineering Analysis and Final Architecture Check

The final step in the architecture rule/policy compliance process would involve a second consultation between the grantee (federal funding recipient who is implementing the ITS project) and the MPO/DOTD. In this consultation, the grantee and MPO/DOTD could verify that an appropriate systems engineering process has been performed and could identify whether any changes have been made in the project since the planning consultation that warrant changes to the regional system architecture. This step would insure that if and when FHWA or FTA examine project compliance with the rule/policy, as part of standard oversight procedures, compliance can be demonstrated. The MPO/DOTD could continue to provide support to grantees if and when FHWA or FTA review indicates a concern regarding compliance.

Table D.2 Considerations for Selected Steps in the Systems Engineering Process

Step in the Process	Considerations
Identification of participating agencies roles and responsibilities	Any necessary agreements, such as memoranda of understanding that will be needed to support the life cycle for implementation, operation and maintenance of the project, should be identified at this stage. The development of those agreements should be performed as part of the project design.
Requirements definitions	Requirements provide the basis for a project design by identifying, in a detailed, discrete manner, what is to be accomplished by the project (functions), how the functions must be executed (performance) and what equipment and standards will be required (technical).
Analysis of alternative system configurations and technology options to meet requirements	<p>The effort associated with this step is highly dependent on the scope of the project being implemented: small, simple projects of a type that have been implemented many times before may require minimal analysis, whereas large, complicated projects of a type that has not been implemented before may warrant more careful consideration alternative configurations and technologies.</p> <p>The pro and con of various system configurations should be considered, and the relative strengths and weaknesses of available alternative technologies should be weighed, considering issues such as cost effectiveness, operations and maintenance impact, and expandability.</p>
Procurement options	Unlike “traditional” road building and transportation capital facilities procurements, many ITS projects, due to the uncertainty involved, do not lend themselves to traditional “low bid” procurement. There is existing federal guidance stating that agencies should definitely avoid using low bid procurement for ITS software projects. Project sponsors are encouraged to consider the full range of procurement options available to them.
Identification of applicable ITS standards and testing procedures	<p>ITS standards define how different ITS technologies interconnect and interoperate. Table 5-1 of the Thurston regional architecture identifies the standards that apply to various components of the architecture. None of the over 80 ITS standards that have been developed and published, or are being developed, have yet been formally adopted by the USDOT. Therefore, usage of the standards is as yet recommended rather than required.</p> <p>During project design, as part of the systems engineering process, the specific tests that will be conducted as part of the design and implementation process should be identified. The identification of these tests is a natural extension of the thinking that generates the system requirements needed for project design. Acceptance testing is a critical component of ITS projects—these tests describe the procedures that will be used to demonstrate that the operational requirements can be met with the system, and that any specification for the use of ITS standards has also been met.</p>

Table D.2 Considerations for Selected Steps in the Systems Engineering Process

Step in the Process	Considerations
Procedures and resources necessary for operations and management of the system	<p>Almost by definition, the operational and management cost component of ITS projects is more significant than for traditional roadway projects. In the case of ITS, merely providing the infrastructure does not produce the desired benefits; the infrastructure must be actively utilized within the context of a specific operational strategy that makes sense. Experience to date with ITS systems has often been that the operational component of ITS, including exactly how the tools will be used, to what ends, and the resources required to operate them, is often under-planned, under-staffed and under-budgeted. As a result, some deployed ITS components, with variable message signs being one example, have been under-utilized in some areas and have attracted considerable public and media criticism.</p> <p>The importance of fully articulating <i>why</i> and <i>how</i> the specific ITS application will be utilized, and allocating sufficient resources to support that plan, can not be over-emphasized. Some of the issues to be considered include: staffing, training, maintenance (skills required, spare parts, equipment) and replacement costs.</p>

APPENDIX E

High-Level ITS Communication Design Concept

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1.0 INTRODUCTION

This document identifies the primary high-level Intelligent Transportation System (ITS) communications network design approach for the Shreveport/Bossier City region. The most appropriate technology capable of meeting and supporting those requirements, in terms of the technology's bandwidth availability, maintainability and cost effectiveness is recommended.

The communications network system will require both a logical (i.e. functional) and a physical connectivity. It is intended that the required connectivity allow various stakeholders the ability to obtain real-time information about traffic operations on controlled access corridors and primary surface arterials. The estimated bandwidth for this type of data communication will vary between 10 Kbps to 1500 Kbps. Video traffic will be provided either continuously or on an as-needed basis among the various stakeholders. The expected video quality will differ depending on the user application. Transmission bandwidths for video communications traffic will likely vary between 384 Kbps to 2 Mbps. From a communications requirement perspective, there is no distinction between data and video communications other than the differing bandwidth requirements. Since the backbone network must be capable of supporting the aggregated volume of information being transmitted across the network, it is implicit that a high bandwidth be provided across the backbone. The network design recommended provides high bandwidth connectivity.

The provision of an appropriate communications network is to adequately serve the communication requirements of the stakeholders. In addition, the communication network design must consider both the network reliability and the security integrity of the network access.

1.1 Design Philosophy

URS believes that in order for any communications network to be successful, be it data, voice, or video, the fundamental technical design considerations are the same. All users and devices must be compatible to afford equal access to the network, honoring any prioritization of access required.

The network must be capable of being connected to other legacy (i.e. existing) networks and systems and must be an open platform. The design engineer must ensure available capacity beyond current demand so that access will not be denied for bandwidth reasons.

Choosing the best technology, or technologies, for a network also depends on network requirements fundamentally driven by the ITS devices and services that will be deployed (e.g., radar vehicle detectors [RVD], closed circuit television [CCTV] cameras, and dynamic message signs [DMS]). It is important to keep the complexity of the network design and the amount of equipment required to a minimum, thereby minimizing the effects of equipment failures and simplifying network management.

A solidly engineered network maximizes the latest available technology and is not built on future potential or hype. Successful engineering relies on solutions that work well today and can effectively migrate to the next “best” technology in the future. The value of deploying a well-engineered communications network, including a system management software package, is important, as studies have shown. A recent study conducted by the United States Department of Transportation (USDOT) Volpe National Transportation Systems Center suggests that the annual cost of operations and maintenance (O&M) for a wireline communications network is approximately \$12,000 per mile of roadway. A significant portion of this cost can be attributed to time spent by maintenance personnel in diagnosing and repairing network failures. On a related issue, these same studies out of the telecommunications industry show that the majority of network faults occur with equipment located at remote sites (i.e., along the roadway and not within the Traffic Management Center [TMC]). Such problems require a special dispatch of trained technicians. Of the time spent correcting network problems, 50% of the technician’s time will typically be spent commuting to the remote site, 30% diagnosing the problem, and only 10% - 20% in actually repairing the failure. Between 20% and 50% of the annual O&M cost can typically be eliminated by deploying hardware that supports remote network management capabilities.

1.2 Design Standards

The URS design philosophy is based upon open (i.e. non-proprietary) standards and protocols following Federal Highway Administration (FHWA) guidelines. These guidelines allow contractors greater flexibility in providing an interoperable solution that best meets project requirements at minimal cost. The underlying protocol used in the design is based on the National Transportation Communications for ITS Protocol (NTCIP) and provides many advantages over proprietary systems. Supporting hardware and software is available from multiple manufacturers versus a single manufacturer as with proprietary designs.

Pertinent guidance from the FHWA document *TEA-21 - Transportation Equity Act for the 21st Century, Sec. 5206. National Architecture and Standards* and the *NTCIP Guide* includes:

- Development, implementation, and maintenance. Consistent with section 12(d) of the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 272 note; 110 Stat. 783), the Secretary shall develop, implement, and **maintain a national architecture and supporting standards and protocols to promote the widespread use and evaluation of intelligent transportation system technology** as a component of the surface transportation systems of the United States.
- Interoperability and efficiency. To the maximum extent practicable, **the national architecture shall promote interoperability among, and efficiency of, intelligent transportation system technologies** implemented throughout the United States.
- **Use of standards development organizations.** In carrying out this section, the Secretary may use the services of such standards development organizations as the Secretary determines to be appropriate.

- **The proper use of NTCIP in a management system will allow the future expansion of the system to benefit from true competitive bidding, as well as allow other types of field devices to be added.**
- **The *Transportation Equity Act for the 21st Century* (known as "*TEA-21*") requires that federally funded ITS projects "conform" with the National ITS Architecture.** As defined in *TEA-21*, the term "intelligent transportation system" means "electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system". The National ITS Architecture defines both the functions performed in implementing ITS, and the information flows between transportation subsystems. In its October 2, 1998 report entitled "*Interim Guidance on Conformity with the National ITS Architecture and Standards*", the USDOT stated **"Highway Trust Fund recipients shall take the appropriate actions to ensure that development of the project(s): (a) engages a wide range of stakeholders, (b) enables the appropriate electronic information sharing between shareholders, (c) facilitates future ITS expansion, and (d) considers the use of applicable ITS standards."**

1.3 Design Advantages of an Open Architecture Approach

The advantages and benefits associated with utilizing an open architecture approach to ITS design can be summarized in terms of the Internet Protocol (IP) on which the World Wide Web (WWW) is based:

- IP is a mature, reliable, proven and well-documented protocol that has been maintained since the 1960s.
- Large selection of vendor products for both hardware and software which support IP.
- IP networks scale to a very large number of devices.
- IP inherently provides flexibility in routing source data to selected destinations.
- A single IP network supports multi-vendor hardware.
- Ease of management from a central location, which can be located anywhere on the Internet or private Intranet.
- Software can be written to take advantage of connectionless-based protocol (UDP) for speed or connection-based protocol (TCP) for reliability.
- Proactive monitoring of critical links and devices along the data network path using readily available, IP-based, commercial network monitoring programs.

- Recent enhancements to switching technology can now take advantage of the IP protocol to provide quality of service and priority-based flow control of network traffic.

1.3.1 Hardware

On the hardware side, open architecture means specifying devices, which are standards-based, allowing the agency to replace, repair, and expand the system employing hardware from multiple manufacturers. The decision to buy in this scenario is based on the best value to the agency at any given time, rather than a decision driven by the single manufacturer who was successful in the first project or contract bid.

1.3.2 Software

For software, open architecture will eventually provide similar opportunities for future system expansion and enhancements. Today, software specifications strive to achieve data portability if a system is migrated to a new platform or application.

There are essentially two approaches to ITS software. One approach is the implementation of a commercial-off-the-shelf (COTS) package with minimal in-house customization. The advantage of this approach is that the software development cost is also minimal, being spread by the seller/manufacturer across many purchases/agencies. Additionally, the software can be kept current through manufacturer upgrades based on the feedback from many users. The other path is a custom application based on accepted standards utilizing open source code. This approach allows the software to be built to suit the needs of the stakeholders with all requested reports and control features. This approach is typically more expensive than the COTS solution. It also makes the agency somewhat beholden to the initial programmer unless the code is rigorously structured and documented according to the Software Engineering Institute's (SEI) Capability Maturity Model (CMM). However, if a change of the programmer occurs, even when strict adherence to the SEI CMM is applied, there will still be some (often-significant) amount of time to for the new programmer to become familiar with the existing code structure. A blend of these two approaches can be employed to derive benefits from each: development costs can be minimized while retaining some customization capabilities. However, this approach can also be implemented to the agency's detriment, resulting in the worst of both worlds: high development costs for customization, while being locked into the developer's revision cycle for the core application. This cycle can be too short and the agency can be continually paying for upgrading and reprogramming to the next version of the software. The revision cycle can also be too long with the agency paying the costs of customizing features that instead should be no cost or low cost patches or regular updates to the core application. In a worst case, the client pays the developer for customizing the application for the client's own use and then the software developer re-uses the code in the revision of the core application (at little or no cost to the developer) and then the client pays the developer to reprogram the local customizations of the previous version of the core application.

The more “locked” to the software developer the agency is, the more expensive the software maintenance. The same is true of the hardware manufacturer. The more open and standards-based the hardware is, the more options the agency has and the lower the life cycle O&M costs will be.

1.4 Design Specifications

The open approach to design specifications lead to more competitive bidding for both hardware and software. When combined with comprehensive construction administration and training for the users and administrators, the result is a flexible system built-in adaptability and scalability to satisfy future needs while minimizing O&M costs.

It is extremely important that Operations and IT staff be involved in planning, design, and procurement process. This will help ensure that the construction services provided by the contractors are adequately specified to facilitate a complete and fully functional system. It is also very important to specify training for all sub-systems and field equipment.

Unit pricing is also a very important consideration. Contractor submittals should include unit prices on all higher cost/quality items to help insure specification compliance and facilitate fair project adds/deducts.

2.0 SYSTEM OBJECTIVES

One of the first and primary considerations when designing an ITS project is to decide how it will be used and, in particular, how the communications sub-system, or network, will transport the large amounts of data and video required to provide real-time transportation information to stakeholders. The data requirements are moderate to high and will likely increase over time. Video transport will require greater bandwidth than the data facet of the system and, this too, is expected to grow over time as devices are added and applications expanded.

2.1 Traffic Management

A key ability of the Intelligent Transportation System is to direct or divert traffic on a large scale. The goal is to keep traffic flowing at optimal rates for safe and efficient travel. This could be either letting people know of construction areas before they get into their cars, or letting commuters know that taking an alternate route would avoid a traffic jam. To use a physics analogy, the communications system must provide ways not only to communicate to the kinetic drivers (those already on the road), but also the potential drivers that are at work or home, preparing for a trip (not yet on the road). To communicate with kinetic drivers, bulletin-board type signs, radio stations, as well as on-board telematics may be used. To reach potential drivers, radio, TV, personal communication devices (e.g. wireless PDAs and cellular phones), and web sites may be used to provide current information. This information could even be tailored to the users needs, on a fee for service basis. Incident response programs can also be a feature of the traffic management aspects of an ITS.

2.2 Emergency Response

Keeping emergency response personnel aware of what is going on at the roadway level will improve their response time and reduce the duration of associated traffic delays. A goal of the communications system is to ensure that emergency personnel have access to all pertinent information necessary to identify and respond to incidents more appropriately and more rapidly. Incidents create traffic congestion and backups. These backups grow quickly and take much time to dissipate. Early intervention can have substantial positive effects on traffic flow. More importantly, quick and appropriate response can improve outcomes for accident victims. A way to accomplish these goals may be to co-locate emergency dispatchers with the ITS operators, at the TMC. An alternative is to provide emergency dispatchers with access to real-time data and video information available through the communications system via a high-bandwidth connection.

2.3 Law Enforcement

Similarly to emergency personnel, law enforcement agencies may also desire to have access to the ITS information. Having that information would enable law enforcement personnel to get a better picture of what may be going on along roadway segments, without needing as many units operating in the field. The Communications Network, in effect, would act as their “eyes and ears,” minimizing staffing on high-traffic days and high-incident locations. Also, coordination with ITS operations staff would enable law enforcement personnel to inform drivers of alternate routes if travel lanes are reduced or routes are closed.

2.4 Maintenance

Implementing an Intelligent Transportation System will assist in general maintenance of the surface transportation system. This is due to the information the DOTD would have available to understand how sections of roadway are traveled. This information includes vehicle speed and volumes. This data can be collected remotely and by time of day and by lane. With this information road sections can be studied and scheduled for repair more efficiently. Repairs can be accomplished on areas that are heavily traveled before their condition becomes critical, limiting traffic volume. With good knowledge of periods of highest use, repairs and maintenance can be scheduled for the least busy times of the day or for a particular season, if a cost analysis shows that approach to be beneficial.

During times of maintenance or repair, components of the ITS can be utilized to provide information to the processing center about the nature of traffic flow (e.g. queues) or weather conditions. The output devices (e.g. dynamic message signs) of the ITS can then be used to communicate information or provide alternative routes to the traveler in real-time.

2.5 Other Information Outlets

The above potential uses of the Communications Network shows a need for high bandwidth for large amounts of video and data transport and the need this information by multiple users and stakeholders. Also, there must be a way to transfer the information from the Communications Network should also facilitate the transfer of information to other “information outlets” such as web sites, radio stations, public access channels and TV media.

3.0 TRANSPORTATION MANAGEMENT SYSTEM COMPONENTS

The Communications Network will consist of many different components: devices to gather information (input); a means to transport large amounts of information (infrastructure); sites to process the information (centers); a way to present the information to those who can use it (output); and a way to store the information for future use (archiving).

It will be necessary for the Communications Network to facilitate information transport between all system devices and components including at least one TMC, which will be the central “brains” of the system. Here, all the data and video from the edge devices are monitored, processed, stored, and distributed to the many sites and stakeholders that may need the information. These sites may even consist of display-orientated edge devices (such as dynamic message signs.) The TMCs contain components such as file/data servers, backup servers, and workstations for the TMC operators. TMCs may also contain devices that distribute information provided by the Communications Network, such as web servers.

When it comes to the administration of the Communications Network, it must be designed to operate with minimal operator intervention. Accordingly, it can be operational 24 hours a day and 7 days a week with little or no staffing required during non-peak periods. Personnel should be able to focus on management/administration of the system rather than full-time operation of the system. This is possible by designing the system with a high-level of automation and an appropriate level of equipment redundancy.

3.1 Traffic Management Center (TMC)

Through the Louisiana ITS design and implementation program, TMCs will be deployed in major metropolitan areas statewide. A Concept of Operations plan developed before the TMC is implemented provides a strong sense of direction, and understanding is gained by documenting the TMC mission and goals. The TMC becomes even more effective when backed up by an ongoing performance analysis and process improvement. The ITS systems installed today provide for fully automated logging of data, status and actions, making such analysis possible. Developing and documenting a Concept of Operations forces the stakeholder agencies to explicitly address and understand operations issues, such as staffing, education and training, information and control sharing, and the decision making hierarchy. It also assists in more clearly defining the system configuration and information content, user interface, and other systems parameters that directly affect and interact with the Communications Network. One of the main goals for developing the Concept of Operations plan is that the system will match the users functional requirements.

Studies show that TMCs realize the full benefits of transportation management only when the control of freeways and surface streets is performed in an integrated manner. Although integration typically requires coordination across agency lines, performing integrated total

network management is viewed as desirable by almost all TMCs. It has also been shown that substantial benefits result from developing cooperative relationships between traffic management, law enforcement, and emergency operations agencies. Centralized integration features personnel from the various stakeholder agencies in the TMC facilities. Decentralized integration is also possible through extensive electronic sharing of voice, data, video, and control capabilities over the Communications Network between the TMC and other centers.

3.2 Transportation Management Software

The system should be designed around an open architecture to enable as much flexibility and upgradeability as possible. This includes designing around the NTCIP standards as they become available, supporting the standard network configurations available today, and to have an IP addressable network. This also means that the system can be expanded easily as the network of devices (both inputs and outputs) grows.

System features to be supported by the Communications Network should include:

- A GIS-based graphical user interface (GUI) is recommended because it enables easy, intuitive operator control over their desktop. Features should include zoom capability, obvious icons for the various field devices, pop-up data entry windows, and real-time summary reports and graphs. The arrangement and selection of options for display should be at the operator's control. The system should be very intuitive to minimize the learning curve for the operators. It should include "pick menus" and have suggested default values in the data entry screens for convenience and speed of entry. The use of color is important to improve recognition of problem areas within the complex background of the map. The user should have easy control of the video images, enabling them to route and configure them to any monitor on the network and to have multiple images operating simultaneously.
- The system must support a large number of inputs and outputs simultaneously. This requires a robust operating system with the ability to continually update and process information in related databases as well as keep the GUI current. To be useful, the system must be easy to operate. It is important that the operator be able to set the threshold parameters for incidents, weather inputs, and traffic flow conditions with just a few mouse clicks, or call up a pre-designed scenario. This also means that the system must be smart enough to suggest possible action items (dynamic message sign messages, special media releases, changes to traffic signal timings, etc.) as certain anticipated conditions occur. Other features are desirable as well, such as secured limits on video camera panning to limit the operator and public view of neighboring residences or businesses for privacy reasons.
- When large numbers of devices are linked it is often more efficient if the devices do some preliminary signal processing in the field rather than at the TMC. For example, a detector might collect and catalog vehicle speeds and then submit a summary statement every 1 to 5 minutes rather than transmit the speeds of each vehicle. This saves on communication costs and provides a faster process when the number of devices gets

large. The system should also support the option of downloading all transactions from specific devices for research or for equipment diagnostic purposes. The system should also store these transactions if communications should fail so they can be downloaded along with more current data when communication is restored.

- The system should support routine diagnostics for the field devices to check on their "health" and assure operational reliability. The system should also support centralized network management tools to diagnose, reroute, and repair network problems with a minimum of fieldwork.
- Traveler information is an important aspect of the system because informed motorists make better decisions and help to resolve congestion by choosing alternate routes. The system needs to conveniently support the distribution of data and videos (at the agencies' discretion) to the media and the public through websites. The system might also enable the degrading of video images to show that an incident is occurring while not enabling the viewer to read the names on trucks or discern the identity of victims.
- Close interaction with police agencies is necessary to process traffic incidents, to provide support and traffic control for emergency response agencies, and for supporting enforcement efforts designed to maintain as smooth a flow of traffic as possible. The system can be designed to output special reports to these agencies on a routine basis or on demand. For example, hourly reports of the vehicle speed distributions can be very useful as a tool for scheduling enforcement details or for simply introducing police vehicles into the stream to stabilize the flow of traffic. Other tools include early warning to police agencies regarding pavement conditions during inclement weather and date stamping the presence of abandoned vehicles to initiate their removal. If the police dispatcher is physically or virtually present alongside the TMC operator, there can be many synergies developed that quickly become useful functions for both agencies. The software needs to be flexible enough to support these new functions by supplying data, graphs, images, and "expert" pre-planned suggested courses of actions in response to varying conditions. This can include step-by-step action plans for closing ramps or lanes when incidents or maintenance activities occur so that important details are not overlooked. The user or system operator needs to have the ability to create these tools on the fly as conditions mandate.

3.3 Network Infrastructure

The network infrastructure is the means by which all of the components in the transportation management system will communicate with each other, in other terms, the "lifeblood" of the system. All the information, whether it be data or video, must somehow get from the roadside (or wherever it may be) to the TMC(s). The network infrastructure is simply the link between the roadside and the TMC. The network infrastructure, in this case, consists of two parts, a core network and an edge network. The core network, a high bandwidth network, is designed for transporting large amounts of information and to be as reliable as possible. The edge network connects all network devices, especially the edge devices, to the network backbone. Another

edge network would be made up of all the workstations and other network devices at a TMC. In this way, the network infrastructure is simply multiple edge networks connected by a single core network. *Figure E.1* shows how a core network and edge network would communicate with each other.

3.4 Edge Devices

The term “Edge Devices” for the Communications Network refers to a device that sits on the “edge” of the network, in most cases next to the physical roadway itself. Most of these devices are sensor-based devices that simply gather information; for example, a camera would be an edge device that captures video. Some other edge devices communicate to travelers; for example, a dynamic message sign. Each of these devices has a certain amount of data or video bandwidth that it requires and hence must be connected to the Communications Network with a certain bandwidth connection in order to be functional.

3.5 Network Operating System

The network operating system (NOS) will be installed at the server level. Flexibility is required, at both the hardware and software levels of the NOS. The local area network operating system should be designed to provide the agency with a great deal of flexibility at the desktop, while maintaining a centralized administrative focus. The server provides access to centralized data storage and provides key services to the client workstations (PCs). Some examples of the services provided are: printer access/sharing, database management, electronic-mail, data access, communications and remote access services, as well as centralized systems administration functions. Another consideration for the network operating system is the need to provide a high level of fault tolerance, along with network authentication (security). It also needs to be easy to use, making it attractive for all applications. Having a flexible network operating system allows for continued growth, dependent on the hardware platform on which it resides.

Some key features must fully support the seven-layer OSI (Open System Interconnection) model, which is the internationally accepted standard for development of communication products and their associated levels of interoperability. Other capabilities include RAID5, disk striping, disk mirroring and drive duplexing, un-interruptible power supply (UPS) support, built in tape backup support, and level C2 security for a high degree of built-in security measures. It also supports a wide range of hardware and supports symmetric multiprocessing, allowing the ability to use more than one processor within a computing environment.

User applications are installed at the workstation level and provide the tools for accessing the network wide services. The tools required to provide complete functionality to the end user are located on the workstations. Operating environment includes office automation tools (word-processing, spreadsheets) and front end processes (data access tools, data base management system query processes). The ability to store information on the workstation exists although it is recommended that crucial data be stored at the server level for security and backup purposes.

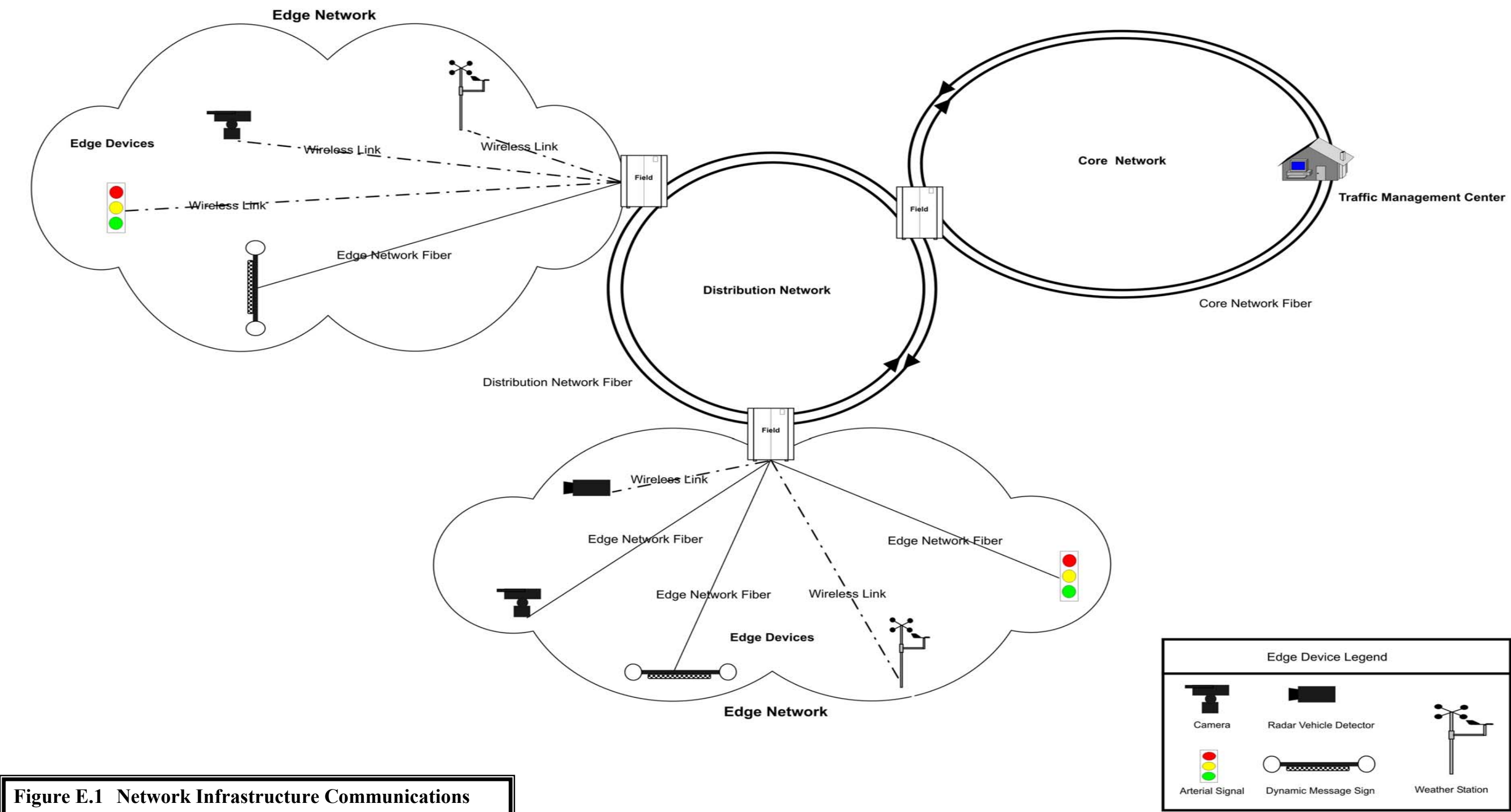


Figure E.1 Network Infrastructure Communications

The capabilities will allow for the “virtual” segmentation of users and resources into local “virtual” workgroups. Defining users within specified virtual work groups allows for an efficient method for easily sharing data and hardware resources such as printers, CD-ROM drives, data directories, fax modems, etc. Defining users into work groups is an effective way to share information and other resources on a local basis. However, it does not limit any individual users from having full use of data information or other resources within the enterprise wide network.

3.6 Network File Servers

Servers fulfill many key roles on a network. They are needed to authenticate users, store files, distribute applications, manage printing services, manage network traffic, and perform backup operations. In most cases servers are dedicated to specific tasks, letting other servers fulfill other tasks. Due to the dependency of normal network functionality on these servers, redundancy is highly recommended. In a redundant system, if a server went down, another server would quickly be aware of this and take over the responsibilities so that no services are lost. This results in a stable network as well as satisfied users.

3.7 Network Management Systems

A combination of Network Management System (NMS) and a Systems Management Software System is recommended and should be centrally located at the TMC for security purposes.

The NMS will likely be product specific and will be included in the Bid Specifications. The NMS will provide a platform that can manage the network components and end user devices while providing key information to the Network Manager as to the status of the network. The NMS needs to be Simple Network Management Protocol (SNMP) compliant.

The management system should provide the ability to do hardware and software inventory, automated software distribution and installation, remote systems troubleshooting, remote control and network application management.

Integrating a network management tracking system will increase the efficiency of the overall system through the identification and resolution of device failures. The TMC administrators should also be aware of the ongoing need to update their design documents to reflect their system “as-built condition,” also known as configuration management. A network management tool is extremely valuable for this purpose.

3.8 Network Backup System

To provide the most flexibility for backup procedures, it is recommended that two file servers be used. One backup server can be connected to the network from an off-site location for disaster recovery purposes. This server would provide a dedicated backup function for either the programs or applications that reside on the network or for the critical data throughout the network.

The file server would also provide the ability to connect additional backup devices, allowing a second method of providing backup services. The ability to load share the large volumes of information would then be in place. The use of the two-server scenario also incorporates an initial level of disaster recovery backup that is important when viewed as part of an overall disaster recovery strategy.

3.9 Network Security

There is the need to address network security. It is recommended that a network security policy be developed. The policy should define the rules by which all users of the network must abide. The depth of the policy will depend on existing rules and regulations that govern these issues, as well as network risk assessment. Analysis of the risk and how much exposure is tolerable will effect the cost of network hardware and software. Network security considers the following three issues:

- Risk Assessment
- Vulnerability
- Security Guidelines

3.9.1 Risk Assessment

Risk assessment is the process of finding out what data is transmitted and how important that data is. In addition to the importance of the data, is the amount of damage that will incur if it is lost or compromised. Traffic information is not considered high-risk data, since it usually deals with non-sensitive public telemetry data from field devices. Compromise of this data can disrupt, but will not severely impact, traffic operations and is easily recovered. On the other hand, compromise of field device control, such as dynamic message signs, has larger security risks because of safety and legal considerations. Secure communications solutions such as firewalls, SSL, IPv6, encryption, and passwords should be considered where the risk warrants it. The fact of the matter is, without a security policy, security can be breached by simply bypassing all of these high technology solutions.

3.9.2 Vulnerability

Looking within the network is the first step in assessing vulnerability. Most network intrusions are from the inside, not the outside. Hackers make up just a small portion of the network compromises that are recorded annually. The vulnerability of a network is dependent on the vulnerability of each office connected. It is therefore recommended that each center configure and maintain a firewall. It is also recommended that each center maintain their workstations and servers in a secure area. If someone can gain physical access to the servers, the servers can be compromised, as well as the network. Vulnerability is not just physical network devices; it also deals with who within the organization will have access to the network.

3.9.3 Security Guidelines

The security policy needs to define the guidelines by which all users of the network must abide. These guidelines should be defined in the following categories:

Categories	Definition
Acceptable use	The kind of activity deemed acceptable and unacceptable on the network.
Access	Who has access to the network and of those people, the areas they are granted access and areas they are denied access.
Privacy	What kinds of security monitoring will be going on? (i.e. monitoring of email, server access, logging of individual users through electronic means, etc.).
Passwords	Guidelines for user passwords such as minimum length, types of characters used and even if they will be assigned rather than chosen by the user.
Enforcement	How to report user violations of policy and what actions will be taken for violations.
Purchasing	How to regulate the purchase and implementation of new hardware and software.
Support and Maintenance	Who is responsible for the upkeep of the network and servers, and who will maintain security in the event of changes or alterations to the system.

4.0 DESIGN PARAMETERS

The Communications Network serves as the information backbone supporting ITS devices and applications. The high-level design concept recommended provides for an open systems architecture, meaning non-proprietary components, and aims at providing an integrated seamless communications network. As additional ITS components (e.g. field devices and applications) are implemented in the short-term and through the long-term, the Communication Network is the key for these elements to integrate seamlessly. Consequently, the Communications Network design places a high emphasis on reliability and efficiency.

4.1 Methodology

The beginning of a network design is to determine the types and magnitude of the communications traffic that will be transmitted over the network and then determine the quality of service (QoS) that will need to be achieved.

When designing a system of this nature, it is impossible to determine the entire communications traffic load that will be transmitted over the entire network. Therefore, assumptions are made. The main communications traffic that will be transmitted over the network is predominantly data and video. The design approach recommended is to identify the parameters for the transport of this information to and from different ITS devices.

4.2 Bandwidth Analysis

Bandwidth requirement is a function of transmission volume (data) and the minimum time period in which the volume must be transmitted (throughput). A two-step process must be followed in order to estimate the bandwidth requirements for a communications network. The volume of the data to be transmitted is determined and then an association is made as to the minimum time period within which the data volume must be transmitted. At this planning level, we are unable to calculate the exact bandwidth requirements. However, we can approximate the requirements for the primary ITS devices planned to be deployed. This will be adequate to determine the best high-level Communications Network architecture.

4.2.1 Data Calculations

This section describes the types of data, refresh rates, and object sizes, and estimates bandwidth requirements for the primary data to be transmitted over the Communications Network.

The following information provides calculations for the communication throughput requirements for various ITS devices (information) that will likely be transmitted across the Shreveport/Bossier City Communications Network.

Detection Devices (e.g. Radar Vehicle Detector)***Assumptions:***

- Object size: 170 bytes (lane by lane)
40 bytes (station)
50 bytes (segment)
- Frequency of refresh: 30 seconds
- 30 second polling rate requires a throughput in excess of 150Kbps (lane-by-lane)
- 30 second polling rate requires a throughput in excess of 50 Kbps (by station)
- 30 second polling rate requires a throughput in excess of 5 Kbps (by segment)

In order to calculate the total bandwidth needed by these devices, the total number of devices used lane by lane, in stations, or in segments needs to be known. For this project, there are a total of 563 radar vehicle detectors (RVDS) planned. Assuming an average of 5 devices per segment yields approximately 113 segments (563/5). If a 30-second polling rate is used for these 113 segments, then the total bandwidth needed for these devices is approximately 7.5 Kbps.

Dynamic Message Signs***Assumptions:***

- Object Size = 0.1 Kb
- Frequency of refresh: 60 seconds

The number of dynamic message signs planned for this project is 16 (includes 3 by others), which means the total bandwidth needed for the signs is approximately 2.3 Kbps

Traffic Signals***Assumptions:***

- Object size: 0.2 Kb
- Frequency of refresh: 60 seconds

There are 395 traffic signals to be accommodated in this project, which translates to a necessary bandwidth of approximately 10.5 Kbps

Therefore, the cumulative total bandwidth necessary for all field equipment (edge devices), aside from the CCTV cameras is about 20.3 Kbps. This is a small bandwidth compared to that needed by the cameras, which is explained in the following section.

4.2.2 Video Calculations

Video will be available from closed circuit television (CCTV) cameras. CCTV video is the most bandwidth intensive application that will utilize the Communications Network. CCTV is a high bandwidth analog communications technology. Therefore, in order to transport this type of communication across the network in a reasonably economical manner, it will be necessary to compress the analog signal and convert it to a digital format.

Full motion, high quality video can require up to 155 Mbps for transmission. There are various techniques that can be employed to reduce the bandwidth required for each video image. These techniques involve digitizing and compressing the video signal using a device called a CODEC (compressor/decomposer). The more the video image is compressed, the poorer quality the image will appear and/or it will update less frequently.

There are a number of conversion and compression techniques (protocols). However, as a practical matter, the dominant protocols for CCTV would be either the international standards organization (ISO) recommendations H.261/H.320 or Motion Picture Experts Group (MPEG) Version 2 (ISO H.262). The quality of the image received depends on the bandwidth. Using a CODEC, the image can be compressed to data rates as slow as 56 Kbps.

Video transmission calculations are rather straight forward depending upon the compression standards selected for transmission. Essentially the compression choice lies between the use of ISO H.261 techniques, which are intended for video-conferencing and are used in the Integrated Services Digital Network (ISDN) environment, versus H.262 (MPEG-2), which is intended for high quality video and deployment in an environment capable of supporting higher bandwidths. The transmission characteristics of H.261 provide for “usable” video at as low as 384Kbps and up to 2 Mbps.

ISO H.261 Compression	
Transmission Rate	Video Quality
56 Kbps	Typically provides still pictures updated every 5 to 7 seconds
128 Kbps	Provides some motion, movements appear jerky and some tiling of the picture is experienced
1.544 Mbps	Provides more motion than 128 Kbps, movements are sometimes jerky and tiling maybe experienced but a significantly lesser degree
5 Mbps	Provides VHS quality, video image appears to be full motion to the average viewer; video professionals can detect minor flaws in the picture quality
150 Mbps	Provides full motion broadcast quality video

ISO H.262 (MPEG-2) Compression		
Transmission Rate	Pixel Resolution	Video Quality
1-2 Mbps	352 x 288	VHS
8-10 Mbps	960 x 576	Educational TV
20-30 Mbps	1920 x 1080	High Definition TV

H.261 compression technology lends itself to transmission over standard commercial telephone facilities. The transmission characteristic of MPEG-2 provides for VHS quality video at rates of approximately 2Mbps. The principal feature difference between the two compression methods is that H.261 transmission tends to “smear” when rapid movement of the subject matter is encountered whereas with MPEG-2 there is no loss of quality. It is also worth noting that MPEG-2 lends itself much better to a communication technology known as Asynchronous Transfer Mode (ATM).

The cost to transmit video is directly related to the amount of bandwidth utilized. For traffic management, it is recommended that full motion be provided for video images transmitted across the communications network. A communications bandwidth of 1.544Mbps per video channel is recommended.

4.2.3 Calculations for Remote Connections

This section provides a framework for TMCs to connect to (i.e. access) the Communications Network (backbone). The intent is that the stakeholders would evaluate their anticipated communications requirements and determine which category meets their requirements. (See *Figure E.2* for an illustration of remote communications.)

Six different categories should offer an adequate range to support all application requirements. The category types are essentially formulated based communication bandwidth requirements and have been developed to offer a range of services.

- High Data/No Video
- Medium Data/No Video
- Low Data/No Video
- High Data/High Video
- High Data/Medium Video
- Medium Data/Low Video

A margin of 30% has been included in each of the estimates to account for growth, occasional traffic, and overhead. The bandwidth provided assumes that the information can be updated within the specified refresh rate. Typical types of data that could be transmitted by TMC have been included.

The following are “ballpark” estimates. It is recommended that, as each TMC is connected to the Communications Network, the agencies reevaluate their needs.

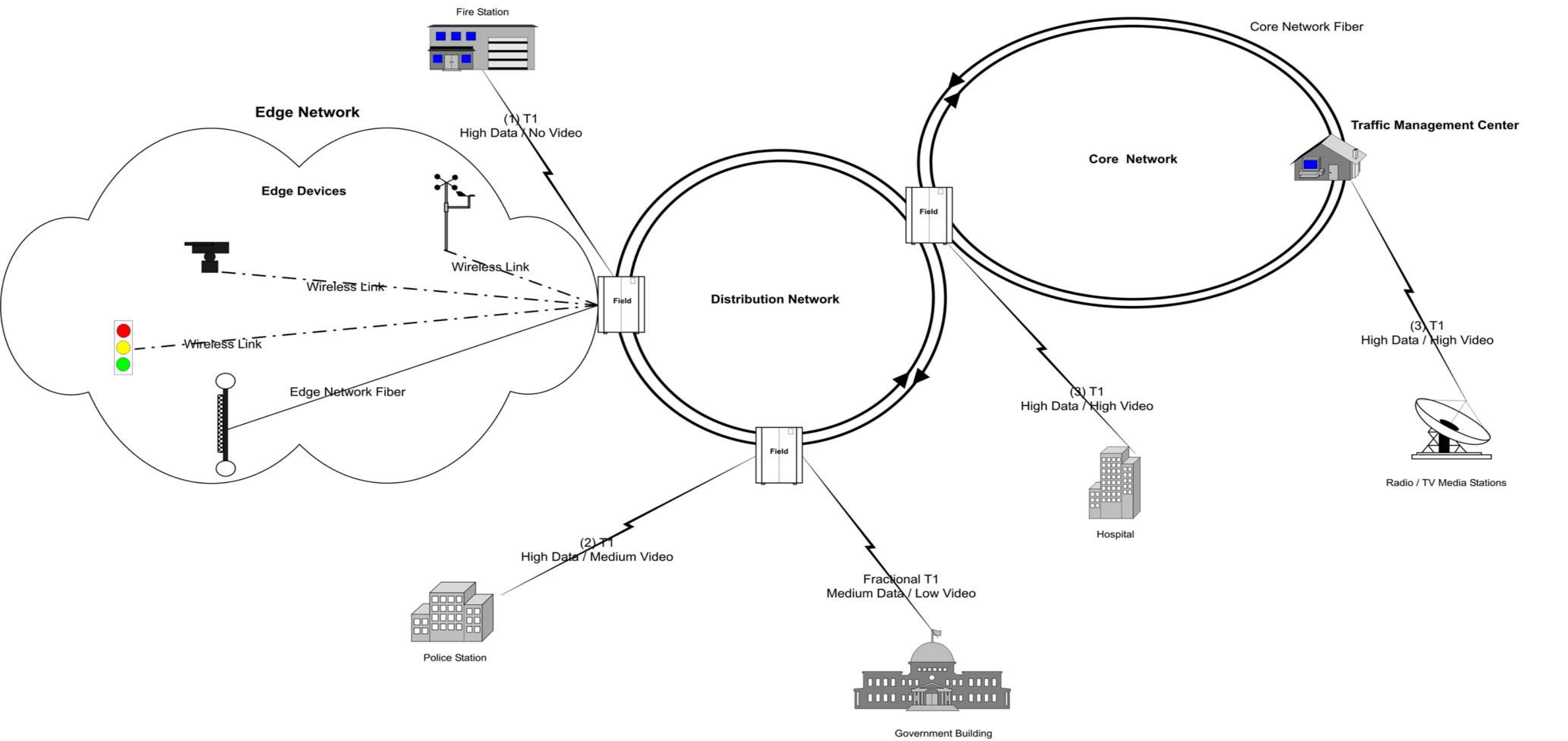


Figure E.2 Remote Communications

High Data/No Video

A High Data user would receive regularly updated traffic congestion information (lane-by-lane), traffic event information, and traffic signal information from multiple regions. The data rate for this type of information is estimated to range from 1 Mbps to 1.3 Mbps. One T-1 circuit (1.544 Mbps) would be required for this type of connection.

Medium Data/No Video

It has been assumed that Medium Data users would receive traffic congestion information (by station), traffic event information, and traffic signal information would be regularly received from a single region. The required data rate should be at least 315.5 kilobits per second. A 384 Kbps circuit is recommended for this type of user.

Low Data/No Video

It has been assumed that Low Data users would receive traffic congestion information (by segment) and traffic event information would be regularly received from a single region. The required data rate should be at least 10.2 kilobits per second. A 56 Kbps data would be required for this type of transmission.

High Data/High Video

In addition to the High Data/No Video requirements as previously described, two T-1 circuits (3.088 Mbps) has been added for video images. Two fairly high quality video images can be transmitted or eight video images of lesser quality at 384 Kbps.

- The required data rate is 1.544 Mbps
- Video bandwidth is 3.088 Mbps

High Data/Medium Video

In addition to the High Data/No Video requirements as previously described, one T-1 circuit (1.544 Mbps) has been added for video images. One fairly high quality video image can be transmitted or four video images of lesser quality at 384 Kbps.

- The required data rate is 1.544 Mbps
- Video bandwidth is 1.544 Mbps

Medium Data/Low Video

In addition to the Medium Data/No Video requirements as previously described, one 384 Mbps circuit has been added for video images. One video image can be transmitted at 384 Mbps or two video images of lesser quality.

- The required data rate is 384 Kbps
- The video requirement is 384 Kbps

As shown in the table below, commercial communications services are normally based on the bandwidth capacity that it will support.

Service	Transmission Speed (Bandwidth)
56 Kbps Frame Relay	Minimum of 56 Kbps
Integrated Services Digital Network (ISDN)	128 Kbps
Fractional T-1 (two levels of bandwidth)	384 Kbps or 768 Kbps
T-1 (Digital Signal Level 1)	1.544 Mbps
T3 (Digital Signal Level 3)	45 Mbps
Asynchronous Transfer Mode (ATM)	155 Mbps

With the exception of the ISDN service, all of the above facility services are normally a point-to-point direct connect service. ISDN is normally a dial-up, switched service.

Summary

Below is an assessment of the cost of each of the categories discussed.

Category	Technology	Bandwidth (Kbps)	Qty	Cost	
				Installation	Monthly
Low Data/No Video	56 Kbps	56	1	\$3,780	\$350
Medium Data/No Video	Frame Relay / Fractional T-1	384	1	\$3,800	\$500
High Data/No Video	T-1 Facility	1,544	1	\$3,800	\$1,375
Medium Data/Low Video	Fractional T-1	768	1	\$3,800	\$800
High Data/Medium Video	T-1 Facility	1,544	2	\$3,800	\$2,750
High Data/High Video	T-1 Facility	1,544	3	\$3,800	\$4,125

The 56 Kbps dedicated digital line option is the most cost efficient and meets the requirements of the low data user. The 56 Kbps dedicated digital line is more than enough to carry expected data traffic and provide a continuous dedicated line with the least cost.

5.0 TRANSPORT AND TECYNOLOGY OPTIONS

This section provides information on the composition of the network infrastructure, an overview on how information is conveyed on the network, and a broad overview of typical applications with advantages and disadvantages of transport and technology options.

The network infrastructure must convey the information it contains over some sort of medium, whether it be copper, fiber, microwave, or radio wave (wireless Ethernet). Each of the network infrastructure technologies discussed herein uses one of these mediums to transmit/receive information. Sometimes one facility may not be available; for example, if there is no way to run fiber or copper to a location, microwave or wireless Ethernet must be used. This illustrates that location and environment can impact the technologies used and hence the architecture of the network infrastructure.

5.1 Transport vs. Technology

When data or any information is to be shared between two points over the network, there must be a means for it to be transported, and a technology to control the data transportation and direct the data to the correct location (see *Figure E.3*). The process that occurs could be demonstrated using a car-traffic analogy. For example, data being transferred to a central processing location is like a person needing to get to a store for milk. In order to get from your house to the store, you would need a road (a transport) and some type of technology to allow you to traverse that “road”. This technology would be a car and all traffic signals and other devices that help control traffic on the “road”. Without the transport (the road) and technology for transportation (the car and traffic control devices), the person would not be able to get to the store for the milk.

In the same way, a connection to share data between two or more network components needs a transport and a technology. Of the connectivity options discussed here, some are transport options, some are technology options, and some act as both.

5.2 Private Networks and Leased Connectivity

Certain connectivity options are available for lease from telecommunication service providers while others are typical of privately-owned networks only. It is important to keep in mind that a leased line has a low installation cost (comparatively), but requires a monthly payment and usually requires an extended contract from the service provider. Also, with a leased line, maintenance costs are included. A privately-owned network has high up front costs plus the costs of maintenance, but often the costs of leased lines ends up being higher due to the monthly fees.

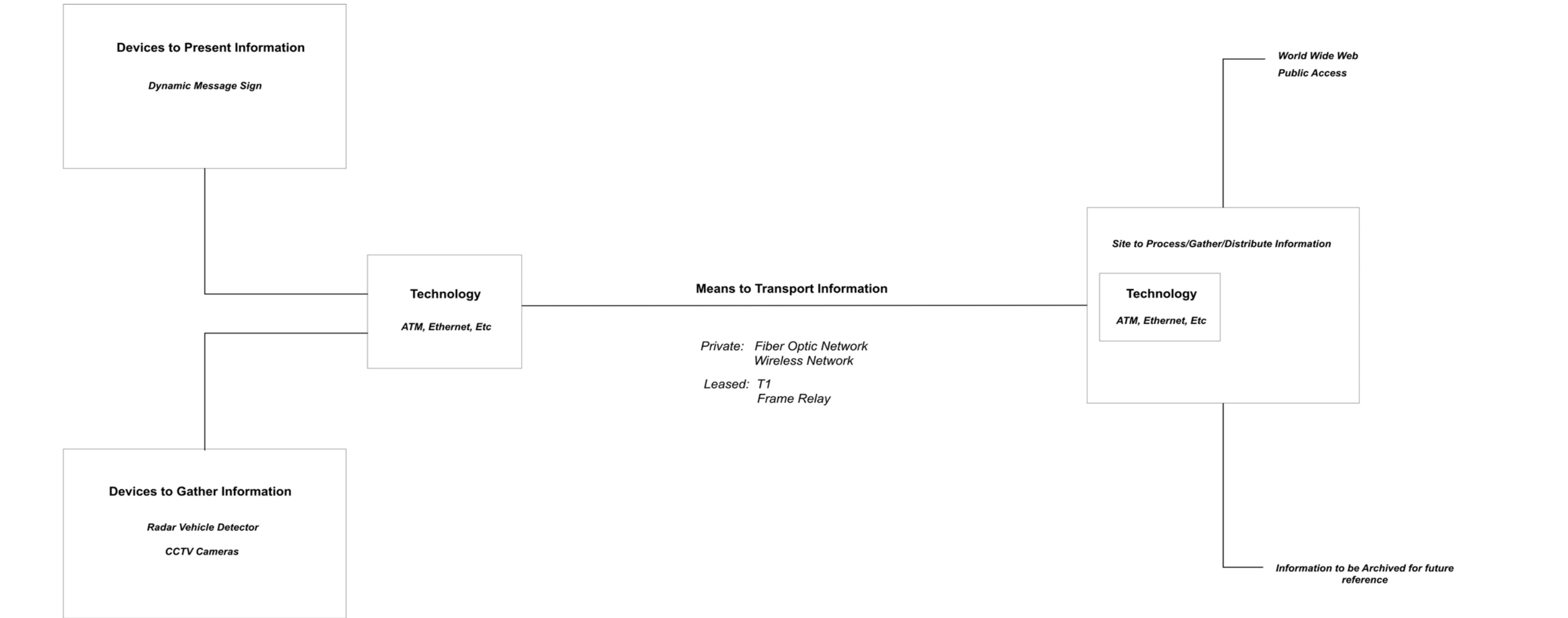


Figure E.3 Transport & Technology

The following connectivity options are covered in the following sections:

Connectivity Option	Type	Network
SONET	Transport (& Technology)	Private Network
T-1 Service	Transport	Leased Connectivity
Asymmetric Digital Subscriber Line (ADSL)	Transport	Leased Connectivity
Integrated Services Digital Network (ISDN)	Transport	Leased Connectivity
56Kbps Digital Dedicated Line	Transport	Leased Connectivity
Ethernet	Technology (& Transport)	Private Network
Wireless Ethernet	Technology (& Transport)	Private Network
Asynchronous Transfer Mode (ATM)	Technology	Private Network
Frame Relay	Technology	Leased Connectivity

5.2.1 Transports

SONET

SONET (Synchronous Optical NETwork) is a standard for optical communications developed by the American National Standards Institute (ANSI). As its name implies, the primary medium for this technology is fiber optic cable. SONET is used for core networks and is designed for very high reliability and very high bandwidth.

Advantages

- Ability to provide services for ATM and different link-layer technologies
- Simple routing due to overhead and synchronous nature
- High bandwidth utilization due to statistical multiplexing
- Potential quality of service guarantees

Disadvantages

- Overhead of cell header.
- Minimum data access rate is 51.84 Mbps
- Necessity for additional layers to transmit data
- Expensive

Service

The T-1 service is a formatted signal at 1.544 Mbps. The T-1 facility can carry twenty-four 56 Kbps voice or data channels. The T-1 protocol is synchronous and uses a timing reference scheme.

The T-1 facility has become increasingly popular with companies as a way of expanding networking capability and controlling costs. The most common use of a T-1 facility is for dedicated transmission between user premises. These facilities allow the user to set up private networks to carry traffic throughout an organization. The typical applications for service are:

- Private Voice Networks. When there is a substantial amount of inter-site voice traffic, a leased private network can provide significant savings over dial up facilities.
- Private Data Network. Similarly, T-1 lines can support high data volumes between two or more sites.
- Video Teleconferencing. Allows relatively high quality video to be transmitted. Private video conferencing links can share T-1 facilities with other applications.

Advantages

- High speed communications
- Quality video signal

Disadvantages

- Expensive
- Recurrent monthly costs, usually requiring a long-term contract

Asymmetric Digital Subscriber Line (ADSL)

Asymmetric Digital Subscriber Line (ADSL) converts existing twisted-pair telephone lines into access paths for multimedia and high speed data communications. ADSL can transmit more than 6 Mbps (optionally up to 8 Mbps) from a telephone central office to a subscriber, and 640 Kbps from a subscriber to the telephone central office. ADSL is capable of bringing multimedia, including full-motion video, to most locations. An ADSL circuit connects an ADSL modem on each end of a twisted-pair telephone line, creating three information channels: a high-speed downstream channel; a medium-speed duplex channel (depending on the implementation of the ADSL architecture); and a POTS (Plain Old Telephone Service) or ISDN channel. The POTS/ISDN channel is split off from the digital modem by filters, thus guaranteeing uninterrupted POTS/ISDN, even if ADSL fails. The high-speed channel ranges from 1.5 to 6.1 Mbps, while duplex rates range from 16 to 640 Kbps. The minimum configuration provides 1.5 or 2 Mbps downstream and a 16 Kbps duplex channel; others provide rates of 6.1 Mbps and 64 Kbps duplex. Products with downstream rates up to 8 Mbps and duplex rates up to 640Kbps are

currently available. ADSL modems will accommodate ATM transport with variable rates and compensation for ATM overhead, as well as IP protocols.

Downstream data rates depend on a number of factors, including the length of the copper line, its wire gauge, presence of bridged taps, and cross-coupled interference. Line attenuation increases with line length and frequency, and decreases as wire diameter increases. Ignoring bridged taps, ADSL will perform as follows:

Data Rate	Wire Gauge	Distance	Wire Size
1.5 or 2 Mbps	24 AWG	18,000 ft	0.5 mm
1.5 or 2 Mbps	26 AWG	15,000 ft	0.4 mm
6.1 Mbps	24 AWG	12,000 ft	0.5 mm
6.1 Mbps	26 AWG	9,000 ft	0.4 mm

Advantages

- High speed data communications
- Quality video signal

Disadvantages

- Distance limitations
- No bandwidth guarantee
- Unregulated

Integrated Services Digital Network (ISDN)

Integrated Services Digital Network (ISDN) provides support for voice and non-voice applications using a limited set of standardized facilities. The following types of channels construct any ISDN access link:

Channel	Use
B channel (64 Kbps)	digital voice or data
D channel (16 or 64 Kbps)	signaling information and packet data
H channel (384, 1536 and 1920 Kbps)	high speed applications

Each channel can be used separately for any communications task, including voice calls, faxes, and data transmission. Two or more channels can be combined into a single larger transmission “pipe”. Channels can be assembled as needed for a specific application (e.g. large video-conferences) and then broken down and reassembled into different groups for other applications (e.g. normal voice or data transmissions). Combining B channels in this manner is called inverse multiplexing or bonding. ISDN channels can be dialed as needed.

Advantages

- High speed data communications
- Reasonable quality video signals
- Able to carry voice and data
- Can be dial-up; charges assessed for usage are flexible

Disadvantages

- Not used for dedicated data exchange
- Requires firewall protection

56 Kbps Digital Dedicated Line

Private line data service provides an end to end digital line. Dedicated circuits can offer point-to-point or multi-point digital lines up to 56 Kbps. This type of service is capable of delivering reliable transmission of high-speed data communications. The typical applications for this type of service are:

- Traditional remote terminal-to-host access
- Traditional remote large area network (LAN)-to-host access
- Video conferencing in high usage environments

Advantages

- Provides sufficient bandwidth for data communication
- Relatively inexpensive

Disadvantages

- Provides very poor quality video communications

5.2.2 Technologies

Ethernet

Ethernet is currently the most widely used technology today for connecting network devices on the workstation level. Ethernet (IEEE 802.3) comes in a variety of speeds and connecting

facilities. The “standard” for Ethernet defines a speed of 10 Mbps but there have been many additions to the standard that incorporate higher speeds, such as 100 Mbps and 1 Gbps. The standard for 10 Gbps is being developed. Most Ethernet connections to the desktop are over copper twisted-pair cabling. Normally for connections between Ethernet switches, fiber is used for bandwidth capabilities and future functionality. Wireless Ethernet has recently become very popular and is covered in the following section. Gigabit Ethernet (1 Gbps Ethernet) has recently become a common technology used for core network connections.

Advantages

- Inexpensive
- Highly Standardized; very compatible with other manufactures
- Easy to implement and manage

Disadvantages

- Uses CSMA/CD for throughput control
- Quality of service implemented with packet tagging software

Wireless

Wireless consists of access points and clients. In this case, the access points will be devices that are attached to the network backbone through some means, and the clients are the edge devices such as the RVDs and CCTV cameras. Though not recommended, wireless communications equipment can utilize unlicensed frequencies so no FCC permit is needed to operate the system. On the downside, these frequencies can be very busy, which means interference is likely. Also, since it is an unlicensed portion of the spectrum, the frequency profile could change dramatically without notice.

Advantages

- Wireless
- Inexpensive compared to other technologies

Disadvantages

- Limited bandwidth

Asynchronous Transfer Mode (ATM)

ATM is a high bandwidth, low delay, connection-oriented, packet-like switching and multiplexing technique. Minimum ATM access speed is 1.544 Mbps. The term “asynchronous” applies as each cell is presented to the network on a “start-stop” basis. In ATM, data is

organized into fixed length entities, called cells, which are delivered at a constant rate across the network.

ATM provides an application-transparent service. That means that the network does not know, and does not care, anything about the user information carried in the cells. Although ATM provides a connection-oriented (virtual circuit) service, it can handle any type of user application. ATM may be used to carry a variety of traffic types including voice, video, data, and images. It can also provide the network infrastructure for public or private local, metropolitan, and wide area networks.

ATM does not use network capacity unless there is information to be transmitted. When there is information available, it is sent through the network along the assigned path. At other times when this channel does not use the bandwidth, information from other channels can use this spare capacity. This sharing, or statistical multiplexing, is particularly important for high bandwidth bursty traffic like compressed video, which might have a peak bit rate 10 times its average bit rate.

To manage the unpredictable mix of information flowing through an ATM network, information to be transmitted is placed in cells that also contain a channel identifier. As cells arrive at a switching point in the network, the identifier is examined and the cell is forwarded along the correct route towards its destination. The path along which cells for a particular call are transmitted is known as a virtual channel and the identifier in the cell is called a virtual channel identifier.

ATM switches are simple and this simplicity allows them to be fast. ATM does not guarantee the correct delivery of cells, or even that they will be delivered at all. ATM only guarantees that cells that are delivered will be delivered quickly and in order. The ATM protocol is simple enough to allow cells to be switched in hardware. Switches at rates in excess of 2 Gbps have been tested in laboratories and switches of 622 Mbps are commercially available.

Advantages

- Flexible bandwidth allocation
- Simple routing due to connection-oriented technology
- High bandwidth utilization due to statistical multiplexing
- Potential quality of service guarantees

Disadvantages

- Overhead of cell header (5 bytes per cell)
- Minimum data access rate is 1.544 Mbps

- Congestion may cause cell losses
- Expensive
- Complicated to administer

Frame Relay

Frame relay is a telecommunication service designed for cost-efficient data transmission for intermittent traffic between local area networks (LAN) and between end-points in a wide area network (WAN). Frame relay puts data in a variable-size unit called a frame and leaves any necessary error correction (retransmission of data) up to the end-points, which speeds up overall data transmission. For most services, the network provides a permanent virtual circuit (PVC). PVC provides the user a continuous, dedicated connection without having to pay for a full-time leased line while the service provider figures out the route each frame travels to its destination. The user can select a level of service quality, prioritizing some frames and making others less important. Frame relay is offered by a number of service providers. Frame relay is provided on fractional or full T-1 lines.

Frame relay is often used to connect LANs with major backbones as on public wide area networks (WANs). Frame relay requires a dedicated connection during the transmission period. It is not ideally suited for voice or video transmission, which requires a steady flow of transmission. A frame can incorporate packets from different protocols such as Ethernet and X.25.

One of the major benefits of Frame Relay Service is that it has reached a level of wide acceptance and broad deployment that makes it an ideal service to use in business applications. Considerations include:

- Periodic Traffic. Although Frame Relay Service can be a cost-effective alternative to leased lines supporting the constant traffic of applications, the cost efficiency is most pronounced when the traffic is variable and or unpredictable.
- Wide Connectivity. This applies when there are many pre-determined remote locations to be accessed that have a relatively infrequent need to communicate (e.g. there might be a need to transfer large database files several times a day to a group of remote sites). Frame Relay Service provides a superb facility for maintaining a list of remote sites and quickly forwarding traffic.
- Large Transaction Sizes. Because access to Frame Relay Service usually operates at 56Kbps and higher speeds, it is a suitable vehicle for graphics document transmission and large file transfers. It supports LAN to LAN interconnection and other transmissions, such as medical/diagnostic image sharing.

- Bursty Transactions. The best application of Frame Relay is for heterogeneous networks that support a variety of applications, some of which are quite large, while others are small. This mix allows the efficiencies for frame relay to be fully utilized.
- LAN. LAN interconnection has become essential in business today. Work group and team sharing approaches to most corporate activities have necessitated the interconnection of LANs at increasingly high bandwidths.

Typical Frame Relay applications are:

- High speed internet access
- LAN/WAN interconnection
- Client-Server transactions
- Remote database access

Advantages

- High speed data communications
- Efficient handling of bursty traffic variance
- Has an inherent mechanism to support data prioritization

Disadvantages

- Not suitable to carry video signals

5.3 Resource Sharing

When installed, the Shreveport/Bossier City infrastructure will be able to carry a tremendous amount of information, but it will have theoretical limits based on current technology (protocols, hardware). The potential capacity of fiber installed five years ago has a much greater potential today, then it did when initially installed. This should be true for the Shreveport/Bossier City infrastructure as well. The capacity will in part be determined by the technology at the given moment.

The stakeholder agencies may find that it would be beneficial to lease fiber or bandwidth to, or share installation cost with, other entities that might benefit from having increased connectivity. An example of sharing cost and leasing fiber would be if a school system wanted fiber between some of their buildings, all of which pass close to the Shreveport/Bossier City SONET ring. In this case, the school would pay for the fiber that connected the buildings to the SONET ring. The school would also share the cost of the fiber and installation for the parts of the

Shreveport/Bossier City SONET ring that they would share. Also, agencies could lease the fiber on the SONET ring that the school system would be using.

If the agencies choose to lease or sell strands of fiber, it will not be necessary for them to manage the network bandwidth, and it may not be necessary to maintain the fiber itself. Each “owner” could be responsible for maintenance of his or her own strands. However, this establishes a scenario where the early purchasers will be tempted to contract for more capacity than they need with the intention of reselling it or sub-leasing it in the future. This could result in many micro-utilities for fiber; every “owner” could become a broker for its fiber. Also, purchasers who are not in the “first wave” may not have adequate fiber for their needs, and the economic incentives for new companies to locate to the area and connect to the network may be reduced.

If instead the agencies decide to provide leased bandwidth, the fiber infrastructure needs to be managed. This will require that the agencies buy and maintain the electronics and hire the staff to manage the infrastructure. They will also need to upgrade system hardware and software periodically to maintain a strong technological position.

6.0 COMMUNICATIONS NETWORK RECOMMENDATIONS

Using today's technologies, we can unite different systems over a single network. This design approach minimizes the use of fibers and field equipment. This also allows for future expansion for reasons that are not yet apparent. By simplifying the network design, centrally locating equipment to the TMC and requiring the field equipment and devices to have remote management capabilities, the network now becomes cost effective to operate, maintain and manage. From a performance standpoint, it now becomes a more reliable network environment.

Given the known capabilities of today's technologies, the best transport/technology solution is a combination of IP (Internet Protocol) and ATM (Asynchronous Transfer Mode), as well as traditional SONET (Synchronous Optical NETWORK).

These recommendations are in accordance with the Regional Architecture developed for the Shreveport/Bossier City region. Additional discussion and technical considerations are presented below.

6.1 SONET

SONET is the recommended standard for the fiber core network and will map both ATM and IP into the SONET standard. ATM is used as a pre-deterministic, quality of service transport service and IP as a ubiquitous transport service. Each technology is applied based on required applications. The network should be designed to run IP into the SONET core and use ATM as the collector and transport technology to bring traffic into core hubs. Together the three technologies work well to ensure high-speed, high-quality service delivery. Combining IP, ATM, and SONET affords the agencies and stakeholders the maximum benefit from each technology. As they now exist, IP, ATM, and SONET each has its own inherent advantages. ATM is more deterministic in that it has more traffic and policy features. It also works very well as a gateway technology and has evolved to meet a T-1 access requirement from the days when it needed a DS3. IP is a ubiquitous protocol that is widely available in homes and offices because it uses standard DSO, time division multiplexing technology. In addition, IP keeps router traffic in a more native element domain and, while IP routing and ATM switching both provide network layer protections through logical restoration, SONET provides physical layer protection by allowing bi-directional line switching, such as in the case of a severe failure like a fiber cut. A further benefit of SONET that other technologies cannot match includes SONET's ability to handle just about any data type over one link. In addition, SONET bandwidth capabilities are unmatched with current specifications running to nearly 10Gbps at OC-192. Quality of service concerns are minimal because data and voice traffic is groomed before hitting the SONET switch, thereby guaranteeing its arrival.

Choosing the best technology or technologies for a network also depends on stakeholder and service requirements. Virtual private networks can be provided over ATM and soon will be provided over IP. Many enterprises are migrating their networks to ATM-based switching to transport mission-critical traffic. Internet service providers (ISPs) are using ATM to ensure quality of service. But the truth of the matter is, that most customers have yet to make a final decision on the technology they will ultimately adopt. Therefore, it is logical for a service provider to use the technologies that customers want and to build core architecture to support a variety of technology migrations. IP is a good packet technology, but today it is random and can only deliver “best effort” transport. Until label switching can be applied to an IP platform, which will then require service providers to move to a hierarchical network design, its functionality remains somewhat limited. Remember that a solidly engineered network maximizes available technology and is not built on future potential or hype. IP and ATM work well together, and SONET, with its physical layer protection and embedded status, is the best current standard.

6.2 Wireless

Wireless communications play a role in augmenting the fiber optic backbone and providing services where fiber cable installation or services are not feasible or cost effective. Specifically, wireless communication can be deployed in locations where wireless is more attractive from a cost benefits perspective for communications to field device densities (e.g. where field devices are in remote locations or there are no highway rights-of-way). URS recommends wireless devices that can operate on different channels simultaneously. This provides network routing by providing different paths for the data to travel. This allows multiple data feeds on different wireless channels to be used together without interference, and to be combined and translated to the wired network at a single point.

When any wireless system is being considered, a Terrain Analysis and Frequency Evaluation should be performed. A Terrain Analysis is important due to the skittish nature of the RF signals that wireless uses, and the effect that the environment has on all wireless communication. Trees, hills, bridges, buildings, and cars will all have an adverse affect on the RF signals. The only way to determine how the environment might affect wireless communications is to conduct a Terrain Analysis and then field verify the results on-site.

Likewise, a Frequency Analysis is a necessity in determining if wireless communications is even possible. The Frequency Analysis may determine that wireless is not possible in all areas. Therefore, other technologies, wireless or not, may be necessary for developing full connectivity. For this reason, different transport/technologies are available to connect the edge network and devices to the core network.